Public Health Assessment for

OMEGA CHEMICAL SITE
(a/k/a OMEGA CHEMICAL CORPORATION)
WHITTIER, LOS ANGELES COUNTY, CALIFORNIA
EPA FACILITY ID: CAD042245001
SEPTEMBER 5, 2001

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

PUBLIC HEALTH ASSESSMENT

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Prepared by:

California Department of Health Services
Under a Cooperative agreement with the
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, fullscale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E56), Atlanta, GA 30333.

TABLE OF CONTENTS

SUMMARY 1

BACKGROUND 3
- A. SITE DESCRIPTION AND HISTORY 3
- B. SITE VISIT 5
- C. DEMOGRAPHICS AND LAND USE 6

COMMUNITY HEALTH CONCERNS 7

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS 8
- A. ON-SITE CONTAMINATION 9
- B. OFF-SITE CONTAMINATION 11

LIMITATIONS WITH THE INVESTIGATIONS DESCRIBED IN THIS PUBLIC HEALTH ASSESSMENT 12

PATHWAYS ANALYSES 12
- A. COMPLETED EXPOSURE PATHWAYS 13
- B. POTENTIAL EXPOSURE PATHWAYS 13
- C. ELIMINATED EXPOSURE PATHWAYS 15

ATSDR CHILD HEALTH INITIATIVE 20

PUBLIC HEALTH IMPLICATIONS 15
- A. TOXICOLOGICAL EVALUATION 15
- B. COMMUNITY HEALTH CONCERNS EVALUATION 20

CONCLUSIONS 21

PUBLIC HEALTH RECOMMENDATIONS AND ACTIONS 22
- A. ACTIONS COMPLETED 22
- B. ACTIONS PLANNED 22
- C. RECOMMENDATIONS FOR FURTHER ACTION 23

PREPARERS OF REPORT 24
CERTIFICATION 25
REFERENCES 26

APPENDIX A - FIGURES 28
APPENDIX B - GLOSSARY 29
APPENDIX C - TABLES 38
APPENDIX D - TOXICOLOGICAL PROFILES FOR CHEMICALS 48
APPENDIX E - MODEL PARAMETERS 59

SUMMARY

The California Department of Health Services (CDHS) has prepared this public health assessment under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). The public health assessment is a mechanism to provide the community with information on the public health implications of specific hazardous waste sites and to identify those populations for which further health actions or studies are indicated.

The Omega Chemical site, which is approximately 40,000 square feet in area, is located between 12504 and 12512 East Whittier Boulevard in the City of Whittier, Los Angeles County, California (1). Prior to 1976, the site housed several different industrial operations. These included: a bullet manufacturer (until 1963), a business that converted vans to ambulances (1966 to 1971), and a chemical processing facility (1971 to 1976) (1). From 1976 to approximately 1991, the Omega Chemical Corporation and Omega Refrigerant Reclamation (which will be referred to as the Omega site), operated as a spent solvent and refrigerant recycling and treatment facility handling primarily hydrocarbons and chlorofluorocarbons (1). The hazardous wastes stored on the Omega site consist of mainly chlorinated and aromatic solvents. Due to past mishandling and/or improper storage of the chemicals and wastes on the Omega site, high concentrations of volatile organic compounds (VOCs) have impacted the soil and groundwater. The Omega site was nominated to the National Priorities List (NPL) on September 29, 1998 by the United States Environmental Protection Agency (USEPA).

CDHS identified soil gas migration as a potential exposure pathway for on- and off-site workers, and residents in the vicinity of the Omega site. Potential soil gas migration into buildings on and off the site may pose a current and future health concern. Because of the lack of indoor air data, it is not possible, at this time, to determine the impact of the contaminants in the soil gas upon the in-building air. This pathway was designated "potential" until further evaluation of the in-building air is conducted. Thus, potential soil gas migration into buildings on and off the site may pose a current and future health concern.

In addition, CDHS determined that contaminated groundwater may pose a future health concern to individuals exposed to it. Specifically, private wells may exist in the vicinity of the Omega site and one of the City of Santa Fe Springs's municipal wells, DWR #2S/11W-32G3, is located approximately 1 mile downgradient of the groundwater contamination. Since exposure to the groundwater is a possible future scenario that could occur if remediation of the contaminated groundwater fails to stop the migration of the groundwater plume, CDHS estimated both non-cancer and cancer doses for children and adults potentially drinking the groundwater. Several of the estimated non-cancer doses exceeded ATSDR's Minimal Risk Levels (MRLs, Appendix B: Glossary), thus, non-cancer health effects could occur if the contaminants measured in the groundwater on-site migrated and impacted private groundwater wells or the City of Santa Fe Spring's municipal wells. Also, CDHS estimated the cancer risk for the contaminants that are carcinogens via the ingestion route and determined that a high increased cancer risk is predicted if the groundwater contaminants from the Omega site impacted the area's drinking water supply.

Contaminated groundwater from the Omega site does not appear to pose a past, current, or future health concern to the citizens of the City of Whittier who drink municipal water. The municipal groundwater wells that belong to the two municipal water suppliers for the City of Whittier are located in the City of Industry, which is located approximately 3.25 miles north of the City of Whittier. Because groundwater contamination from the Omega site is moving in a southwest direction, it does not and will not likely have any health impact on the City of Whittier's municipal water supply.

According to the USEPA, there are no known private domestic groundwater wells that are in use downgradient or in the vicinity of the Omega site. However, a well survey would need to be completed to confirm this. Until a well survey can be completed, the use of contaminated groundwater from private domestic wells must be considered a potentially completed exposure pathway.

Based on the review of available data, CDHS believes that the Omega site poses an indeterminate public health hazard.

BACKGROUND

The California Department of Health Services (CDHS) has prepared this public health assessment under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR, located in Atlanta, Georgia, is a federal agency within the United States Department of Health and Human Services. ATSDR is authorized under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 to conduct public health assessments at hazardous waste sites on the National Priorities List (NPL). This public health assessment (PHA) evaluates the public health significance of the Omega Chemical site (which will be referred to as the Omega site in this document) and is based on a review of environmental sampling data and consultation with involved agencies and the community.

A. SITE DESCRIPTION AND HISTORY

The Omega site, which is approximately 40,000 square feet in area, is located between 12504 and 12512 East Whittier Boulevard in the City of Whittier, Los Angeles County, California (Appendix A: Figures 1 and 2). There are two buildings on the Omega site: a 24,000 square foot warehouse and a 2,400 square foot administrative building. The Omega site is paved with concrete and is surrounded by a 7-foot high chain link fence topped with razor wire (1).

Prior to 1976, the site housed several different industrial operations. These included: a bullet manufacturer (until 1963); a business that converted vans to ambulances (1966 to 1971); and a chemical processing facility (1971 to 1976) (1).

From 1976 to approximately 1991, the Omega Chemical Corporation and Omega Refrigerant Reclamation, operated as a spent solvent and refrigerant recycling and treatment facility handling primarily hydrocarbons and chlorofluorocarbons (1). The Omega site received and processed drums and bulk loads of waste solvents and chemicals from various industrial activities to form commercial products that were either returned to the generators or sold in the marketplace. The hazardous wastes stored on the Omega site consist of mainly chlorinated and aromatic solvents. In June 1995, before removal activities, there were thousands of drums of hazardous waste, two roll-off bins of hardened resin material, hundreds of empty contaminated drums, numerous cylinders weighing from 15,000 to 20,000 pounds, and various other smaller containers of waste and/or hazardous waste stored on the Omega site (2). In addition, there were several hundred 55-gallon drums containing chemical products and hazardous materials stored in the warehouse on the Omega site.

Between 1985 and 1988, three environmental investigations were conducted at the Omega site under the oversight of the Los Angeles County Departments of Health Services (LACDHS), Public Works (LACDPW), and Fire (LACFD) (1). These investigations included sampling of the soil gas (i.e., contaminants in soil and/or groundwater volatilize, resulting in contaminated gases migrating upward through the soil air space), soil and groundwater beneath the Omega site.

In 1985, LACDHS' environmental contractor, Crandall, collected subsurface soil samples near the western corner of the Omega site. Volatile organic compounds (VOCs) were detected from five shallow soil borings (approximately 3.5 feet below ground surface) (1).

In 1987, Fred R. Rippy, Inc. (a previous business owner and operator at the Omega site) hired an environmental consulting firm, Leighton & Associates, to document the removal of a 500-gallon underground storage tank (UST) and to sample the contents of the UST and surrounding soils. The contaminants in the soil and the UST included: total hydrocarbons, total VOCs, and acetone. In 1988, two environmental investigations were conducted at the Omega site to assess the subsurface conditions. The environmental consulting firm, Environmental Research & Technology (ER&T) conducted a soil gas survey for the Omega site. ER&T detected elevated concentrations of VOCs in the soil gas across most of the Omega site, with the exception of the northeastern corner. VOCs were reported in a qualitative format without actual concentration values (1). During that same year, soil and groundwater sampling was conducted by ENSR Consulting & Engineering (formerly ER&T). The VOCs detected in five soil borings (ranging from 5 to 75 feet below ground surface) included: tetrachloroethylene (PCE), Freon 113, trichloroethylene (TCE), and methylene chloride (1). Other VOCs were detected less frequently and/or at lower concentrations (1). In addition, three groundwater samples were collected and analyzed from monitoring well BMW-1 (installed in the western portion of the site). The contaminants in the groundwater included: Freon 113; and lower concentrations of trichloroethane (TCA), Freon 11, 1,1-dichloroethene (1,1-DCE), and PCE (1).

Since 1991, the California Department of Toxic Substances Control (DTSC) and the United States Environmental Protection Agency's (USEPA) Hazardous Waste Management Division have been actively trying to get the owner/operator to remove the wastes and clean up the Omega site (2). On May 9, 1996, USEPA issued CERCLA Administrative Order No. 95-15 to the owner of the Omega site and to generators of hazardous waste that had shipped major quantities of material to the Omega site requiring them to clean up the Omega site (2). The owner of the Omega site and the generators of hazardous waste will be referred to as the "responsible party group." This Administrative Order was carried out in two phases.

During 1995, USEPA's Superfund Emergency Response Office oversaw Phase I Drum Removal Activities (DRA), during which the responsible party group removed over 4,000 steel and polyethylene 55-gallon drums from the outside storage pad, administration building, and warehouse (1,2). These drums, as well as recovered and generated liquids, were removed to various off-site treatment, storage and disposal facilities (TSDFs) (1). In addition:

- approximately 60 cubic yards of solidified resins stored on the Omega site were removed to an off-site facility for incineration;
- five 5,000-gallon above-ground storage tanks (ASTs) were sampled, emptied, and disposed at a landfill; the contents were incinerated at an off-site facility;
- two rainwater sumps and four evaporators on the southern portion of the site were pumped out, and the rinsate transported to an off-site TSDF;

- two 500-gallon empty cooling towers were cleaned and confirmation wipe samples were obtained;
- approximately 40,000 gallons of rinsate and decontamination water were transported to an off-site TSDF;
- sixty-seven refrigerant gas cylinders were sent off-site for reclamation or destructive incineration. A total of 165 empty or usable cylinders were left on the Omega site at the completion of the DRA; and
- following removal of the drums and hazardous materials, the remaining facility process equipment and structures were decontaminated and wipe sampled in accordance with the USEPA-approved DRA Workplan (1).

Phase II activities began in November 1995 and included the collection and analysis of subsurface soil, groundwater, and soil gas at the Omega site by the responsible parties (1). This PHA evaluated the soil, groundwater, and soil gas data obtained during the Phase II activities to determine if there are current and future exposures to on-site related businesses and the community in the vicinity of the Omega site. Based on the analytical results obtained during the Phase II activities, the contaminants detected in the subsurface soil include: PCE, TCE, 1,1-DCE, Freons and other chlorinated hydrocarbons, and metals (1). The contaminants in the groundwater included: PCE, Freons and other chlorinated hydrocarbons. In addition, a groundwater plume contaminated with PCE has migrated downgradient of the Omega site. This contamination appears to have migrated in a southwesterly direction. However, the vertical and horizontal extent of the contamination is not currently known. The contaminants detected in the soil gas include: Freon 113, Freon 11, PCE, and TCA (1). Currently, USEPA is in the process of conducting an in-depth investigation of the Omega site and evaluating cleanup alternatives.

B. SITE VISIT

On July 17, 1999, two CDHS staff members, Sherry Chan and Primitivo Rojas, visited the Omega site. The Omega site is located in a mixed residential and industrial area. Across Whittier Boulevard, there is a residential neighborhood. There are many businesses adjacent and near the Omega site.

Ms. Chan and Mr. Rojas met with the current site tenant who was planning to manufacture plastic furniture in the warehouse on the Omega site. This individual gave CDHS staff a brief tour of the warehouse. The Omega site is surrounded by a metal fence topped with razor wire. There were three caution signs posted on the front metal fence entrance, "Beware of Dog," "Peligro Personal Autorizado Solamente" (which translates to "Danger Authorized Personnel Only"), and a chemical placard (that used numbers and color signs to define the basic hazards of specific chemicals that are used on-site). The site is covered with concrete (both inside the warehouse and outside in the yard area). The properties adjacent to the Omega site are also covered with concrete.

During the site visit, both entrances of the warehouse were opened. The warehouse appears to be fairly dilapidated and leaky (i.e., it was not constructed "air tight," thus, outdoor air can easily flow inwards). There were several rooms located in the warehouse. The room closest to the main entrance housed a chemical laboratory. According to the current site tenant, the chemical laboratory was operated by the owner of the Omega site until USEPA forced him to shut down the laboratory. The current site tenant plans to manufacture plastic furniture equipment in the central area of the warehouse. One of the pieces of his plastic furniture machines, which appeared to be extremely old, was placed in the middle of the warehouse. The current site tenant stated that he was planning to paint the piece of equipment and work on the wiring. He also stated that he will have approximately 11 plastic furniture making machines in operation. In addition, there were many items stored in the warehouse (clothing, children toys, mattresses, etc.). According to the current site tenant, those items were donated to him and he plans to ship them to Ukraine as a donation. Also, there was a dining area set up with a table and chairs and food items. In the back of the warehouse, there were two rooms. One of the rooms contained a sofa set, a television, and an air-conditioning unit. During our tour, the current site tenant's three teenage sons were working in the back of the warehouse. We asked if the current site tenant and his family were living in the warehouse. He stated that the warehouse was only used as storage for the last year and a half.

After visiting the main area of the warehouse, CDHS personnel visited the loading dock sump. This is the area where the highest concentration of contamination was found. The loading dock is located in the southern end of the warehouse. The entire front portion of the loading dock is opened to the outside area. The loading dock sump appeared to be a concrete box sunken into the ground. It was empty and partially covered with a metal grate. There was a winding metal staircase that reached the ceiling of the warehouse. There were many items stored in this section of the warehouse. On the shelves, there were many containers of paints and caulking materials. The current site tenant stated that he was planning to do a little repair work around the warehouse.

CDHS personnel also visited the yard of the warehouse. There was an office building near the warehouse which was closed. According to the current site tenant, the owner of the Omega site was in Ireland for a business trip. There were many pieces of large equipment stored in the yard. There were also many used computers. The current site tenant stated that he plans to salvage all usable parts of the computers and reuse them.

After CDHS personnel visited the Omega site, they visited two nearby businesses, Whittier Skateland (12520 Whittier Blvd) and Kaiser Permanente (12470 East Whittier Boulevard). This part of the visit will be covered in the Community Health Concerns section.

C. DEMOGRAPHICS AND LAND USE

The Omega site is located in a mixed industrial and residential neighborhood and located adjacent to several businesses (e.g., Pittman Inc., Medlin & Sons, Whittier Skateland). Across the street from the Omega site (north of Whittier Boulevard) is a residential area which consist of houses and apartment units. There are two municipal water suppliers for the City of Whittier: Suburban Water System and the City of Whittier (3). Suburban's groundwater well field, Bartolo Well Field, and the City of Whittier's groundwater wells are located north of the City of Whittier on Mission Mill Road in the City of Industry. Since both well fields are located approximately 3.25 miles north of the Omega site, neither Suburban's nor the City of Whittier's groundwater wells have been impacted by the contaminated groundwater plume that has migrated off the Omega site in a southwest direction. The nearest downgradient municipal drinking water, DWR #2S/11W-32G3, to the Omega site is owned by the City of Santa Fe Springs. The groundwater from DWR #2S/11W-32G3 serves the City of Santa Fe Springs. It is located 1.1 miles to the southwest of the Omega site. Current information indicates that this well has not been impacted by the contaminated groundwater emanating from the Omega site. According to USEPA, there are no known private domestic wells that are in use downgradient or in the vicinity of the Omega site (4). USEPA has indicated that they plan to conduct a well survey of all potential downgradient groundwater wells, but have not indicated a timeline for this activity (4).

Based on the 1990 census, approximately 23,805 people live in the City of Whittier (5). The ethnic makeup is 52% Hispanic; 11% Caucasian; 3% Asian or Pacific Islander; 1% African American; 0.3% American Indian, Eskimo, or Aleut; and 32% other race (5). In 1990, 29% of the total population was under the age of 18, and 12% was over the age of 65 (5).

COMMUNITY HEALTH CONCERNS

In July 1999, CDHS contacted the USEPA public participation representative for the Omega site. The USEPA representative reported that they were aware of only a few health concerns that were raised. At a small public meeting with mostly business owners held by the USEPA in June 1999, the community expressed health concerns about the presence of contaminated soil and soil gas. The plan for public participation and assessment of concerns relative to the risk assessment and possible remediation is still being developed by USEPA.

As mentioned previously, CDHS conducted a site visit in July 1999 and met with the tenant of the Omega site and some of the nearby businesses (6). The tenant stated that he did not have any health concerns and mentioned that he had been renting the space at the Omega site for over a year. He stated that he didn't have any concerns for his three teenager sons who are on site occasionally.

The manager at a skating rink, located next door to the Omega site, was concerned about the potential economic impact of health implications of the site (6). He mentioned that about 10 years ago there was some clean-up occurring at the Omega site that impacted his business. He mentioned that at this point in time neither he nor his staff had any health concerns related to the Omega site.

The medical office administrator of Kaiser Permanente, which has an office building near the Omega site, reported that she was concerned about odors and the source of the odors (6). She wanted to know if the odors were from the Omega site. She mentioned that according to an in-house engineer, the odors may be sewer gases due to the faulty plumbing design in the office building. She mentioned they had three odor episodes in the last couple of years. She stated that they had to evacuate all the people in the Kaiser building during one of the odor occurrences.

On June 1 and June 2, 2000 Sherry Chan and Primitivo Rojas canvassed the area near the Omega Site to distribute a summary flier of the PHA for the Omega site. Approximately 125 one page summaries were distributed to nearby residents and businesses. An additional 30 copies of the public comment draft of the PHA for the site were distributed. A summary of the conclusions were provided to the people receiving copies of the report. Residents and businesses were encouraged to call if they had any health concerns or comments. The people receiving the information expressed their appreciation for these outreach efforts.

Copies of the one page summary and the draft public comment PHA were also provided to the city clerk and civil engineer of the city of Sante Fe Springs. The city representatives agreed to make the information available to residents. This information would be available to the public for their review and comments. The same information was provided to the city of Whittier to the director of public works and the city clerk.

In general, people appreciated the direct effort to inform and communicate about the results of work done at the Omega site. Many of the people receiving the information were not aware of the Omega site. Primitivo Rojas provided interpretation into Spanish for ten households. The residents preferred the information in Spanish. No direct comments were received from this effort to solicit public comments.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

CDHS has identified three potential exposure pathways at the Omega site. The three potential exposure pathways are derived from receptor populations that may be exposed to contaminants from the "contaminant source areas" (described below). These pathways involve potential exposures to workers on the Omega site and off-site workers and residents in the vicinity of the Omega site. The contaminants are the result of past practices (mishandling and/or improper storage of chemicals and wastes) at the Omega site. These chemicals can potentially enter buildings by the way of the soil gas and are impacting the groundwater beneath the site. In addition to the Omega site related contaminants, several other industries (e.g., Cal-Air, Leggett & Platt, Terra Pave) are located in the vicinity of the Omega site and may be a source and/or contributing to the soil gas, groundwater, and soil contamination (Appendix A: Figure 3). The existence of a public health hazard is dependent on the magnitude of contamination in the various environmental media and not the source.

The following conditions were used to select contaminants for further evaluation: 1) concentrations of contaminants on and off site; 2) field data quality, laboratory data quality, and sample design; 3) comparison of on-site and off-site concentrations with environmental comparison values; and 4) community health concerns. Comparison values, developed by ATSDR and USEPA, were used to select contaminants for further evaluation and are listed in a glossary in Appendix B. The evaluation of the health effects associated with exposures to contaminants is accomplished by comparing the level of contaminants to "comparison values." Although off-site contamination may not be the responsibility of the Omega responsible parties, the comparison values are determined by ATSDR and other agencies to allow for a general screening of contaminants found at sites under investigation. These comparison values allow an investigator to quickly sort the contaminants into groups that are either not likely to cause health effects, or contaminants that should be evaluated further. Contaminants that receive further evaluation exist at concentrations that exceed the comparison values, and are called "contaminants of concern."

A. ON-SITE CONTAMINATION

SUMMARY OF THE SOIL GAS INVESTIGATION

Between November 13 and 17, 1995, England & Hargis conducted a soil gas investigation at the Omega site (1). Soil gas samples were collected from 30 locations, SG-1 to SG-30 (Appendix A: Figure 4) at six and twelve feet below ground surface (bgs). The soil gas samples were analyzed for the following contaminants: Freon-12, Freon-11, dichloromethane, trans-1,2-dichloroethene, 1,1-dichloroethane, cis-1,2-dichloroethene, chloroform, 1,1,1-trichloroethane (TCA), 1,2-dichloroethane (DCA), trichloroethene (TCE), tetrachloroethylene (PCE), 1,1-dichloroethene (DCE), Freon-113, benzene, toluene, ethyl benzene, and m,p,o-xylenes. At sampling location SG-10 (location of the former concrete loading dock sump), a soil gas sample was not collected at 12 feet bgs due to the inability of the probe to penetrate the soil. Thus, an additional soil gas sampling location, SG-31, was added approximately five feet southwest of SG-10. At SG-31, a soil gas sample was collected at 3.5 feet bgs. Also, three deeper soil gas samples were collected from locations SG-4 (16.7 feet bgs), SG-16 (24 feet bgs), and SG-19 (24 feet bgs).

Based on the soil gas investigation, VOCs were detected in 56 of the 63 soil gas samples which represented 28 of the 31 locations sampled (Appendix A: Figure 4). The analytical results of the soil gas investigation are summarized in Table 1, Appendix C. The most prevalent VOCs detected in the soil gas at the Omega site and at the highest concentrations were Freon 113, Freon 11, 1,1,1-TCA and PCE (1).

During drilling operations by Camp, Dresser, and McKee in the summer of 1999 six soil gas samples were collected at various depths and analyzed for VOCs at location OW-1b (7). PCE, TCE, 1,1,1-TCA, 1,1-DCE, chloroform, Freon 11 and Freon 113 were detected in these samples. PCE concentrations generally increased with depth and ranged from 150,000 parts per billion (ppb) at 10 feet bgs to 6,100,000 ppb at 60 bgs (7).

SUMMARY OF THE SUBSURFACE SOIL INVESTIGATION

Between December 11 and 14, 1995, England and Hargis, contractors for the responsible parties, conducted shallow subsurface soil sampling on the Omega site (1). Soil samples were collected from fifteen shallow soil boring locations, SB-1 to SB-15. Soil samples were collected from approximately 1 foot and 6 feet bgs at each of the soil boring locations (Appendix A: Figure 5). The soil samples were analyzed for metals, VOCs, semi-volatile organic compounds (SVOCs), and chlorinated pesticides (Appendix C: Tables 4 to 7). Based on the shallow subsurface soil sampling investigation, several contaminants were detected above ATSDR's health comparison values (HCVs) or USEPA's Preliminary Remediation Goals (PRGs). Metals detected above ATSDR's HCV or USEPA's PRGs include: antimony, arsenic, barium, chromium, nickel, and vanadium. VOCs detected above ATSDR's HCV or USEPA's PRGs include: 1,1-DCE, methylene chloride, TCE, PCE and toluene. The highest concentrations of VOCs were detected in soil samples collected and analyzed from SB-9, located beneath the loading dock (1). The only SVOC detected above ATSDR's HCV is benzo(a)pyrene. Aroclor 1254 was the only PCB detected above ATSDR's HCV. There were no chlorinated pesticides detected above health comparison values.

In addition to the shallow subsurface soil samples collected from 1 foot and 6 feet bgs, seven deep subsurface soil samples (C1, C2, C3, C7, C7A, H1, H2 and H4) were collected on the Omega site (Appendix A: Figure 5). Soil samples were collected at depths ranging from 15 to 75 feet bgs and 55 to 110 feet bgs from C-series and H-series deep subsurface soil borings, respectively. The soil samples were analyzed for VOCs (Appendix C: Table 5). PCE was detected in the deep subsurface soil samples above ATSDR's HCV. The maximum concentration of contaminants in the subsurface soil are summarized in Table 2, Appendix C.

The soil gas data that were collected add insight into the nature of the contamination at the Omega site. Soil gas data are useful when evaluating the source of in-building contamination and/or the potential for soil gas migration into buildings. For these reasons, the soil gas data can not be directly used for health risk assessments, but they can be used to estimate the concentrations of contaminants in the in-building air with the use of air models and they may help pinpoint any future indoor air sampling efforts.

During drilling operations by Camp, Dresser, and McKee in the summer of 1999 soil samples were collected at locations OW-1b, OW-2 and OW-3 and analyzed for VOCs (7). PCE was the compound detected most frequently, ranging in concentration from 4.7 micrograms per kilogram (ug/kg) at 120 feet bgs to 3,300 ug/kg at 70 feet bgs at location OW-1b (7).

SUMMARY OF THE SURFACE SOIL INVESTIGATION

The Omega site is paved with concrete so there is no surface soil to sample.

SUMMARY OF THE GROUNDWATER INVESTIGATION

Between January 29 and February 1, 1996, England and Hargis, contractors for the responsible parties, conducted groundwater sampling for the Omega site (1). Groundwater samples were collected from four on-site locations, H-1 through H-4 (Appendix A: Figure 6). Nine groundwater samples were collected from depths ranging from 60 to 70 feet bgs and analyzed for VOCs (Appendix C: Table 5). Contaminants in the groundwater detected above ATSDR's HCV or USEPA's PRG include: acetone, benzene, chloroform, 1,1-DCE, 1,2-DCA, methylene chloride, PCE, toluene, TCE, 1,1,1-TCA and trichlorofluoromethane. Freon 113 was detected in the groundwater samples ranging from 2,000 to 6,400 microgram per liter (ug/L). These concentrations are well below ATSDR's reference dose based media evaluation guide (RMEG) for children of 30,000 ug/L. However, these levels are above California's safe drinking water standard of 1,200 ug/L.

During May and June 1996, groundwater samples were collected from deep soil boring B-4 and monitoring well, OW-1, and analyzed for VOCs (Appendix A: Figure 6; Appendix C: Table 5). The groundwater samples were collected from depths of approximately 75 feet bgs. Contaminants in the groundwater detected above ATSDR's HCV or USEPA's PRG include: chloroform, 1,1-DCE, 1,2-DCA, methylene chloride, PCE, TCE and 1,1,1-TCA . The maximum concentrations of groundwater contamination are summarized in Table 3, Appendix C.

B. OFF-SITE CONTAMINATION

SUMMARY OF GROUNDWATER INVESTIGATIONS

Between July 15 and 20, 1996, England and Hargis, contractors for the responsible parties, conducted groundwater sampling southwest of the Omega site to assess the lateral extent of the groundwater contamination (1). Groundwater samples were collected from eight off-site locations, H-6 through H-13 (Appendix A: Figure 6). Groundwater well H-13 is located approximately 1,500 feet southwest and downgradient of the Omega site. This well is the furthest well from the Omega site. The maximum concentrations of groundwater contamination are summarized in Table 3, Appendix C. Groundwater samples were collected from depths ranging from 72 to 122 feet bgs and analyzed for VOCs (Table 5). Contaminants in the groundwater detected above ATSDR's HCV or USEPA's PRG include: acetone, benzene, chloroform, 1,1-DCE, 1,2-DCA, methylene chloride, PCE, toluene, TCE, 1,1,1-TCA and trichlorofluoromethane. Freon 113 was detected in the groundwater samples ranging from 700 to 7,500 ug/L. These concentrations are well below ATSDR's reference dose based media evaluation guide (RMEG) for children of 30,000 ug/L. However, some of these samples are above California's safe drinking water standard of 1,200 ug/L.

Between June 15 and July 2, 1999, Camp Dresser and McKee conducted additional groundwater sampling at the Omega site (7). Groundwater samples were collected from three newly developed wells (OW-1b, OW-2, OW-3) and one existing well (OW-1) and analyzed for VOCs. PCE, TCE, 1,1,1-trichloroethane, 1,1-DCE, Freon 113 and Freon 11 were detected in all four groundwater wells. Tetrachloroethene, TCE and 1,1-DCE were above health comparison values in all four groundwater wells. The highest concentrations were detected in OW-1 with 1,200 ppb 1,1-DCE, 23,300 ppb PCE and 1,300 ppb TCE. Well OW-1 is screened between 62.5 and 77.5 feet. The deeper OW-1b is screened from 110 to 120 feet bgs. Samples collected from OW-1b had detections of VOCs that were generally two orders of magnitude lower than concentrations detected in OW-1. This information suggests subsurface conditions may be inhibiting the vertical migration of Omega groundwater contamination. However, based on current information, it does not appear that the full vertical extent of the groundwater contamination has been identified.

LIMITATIONS WITH THE INVESTIGATIONS DESCRIBED IN THIS PUBLIC HEALTH ASSESSMENT

Limitations in the scope of an investigation and/or lack of data (data gaps) can be a source of uncertainty associated with any scientific investigation. Limitations of this PHA are related to data gaps in our understanding of soil gases at the site and information about the downgradient extent of the groundwater plume eminating from the Omega site. Most of these limitations should be resolved because investigations of the Omega site by USEPA are addressing these issues. In particular, the leading edge of the groundwater contamination from Omega has not been identified yet. USEPA is currently installing sentinel wells downgradient of known contaminated areas. These wells should help track or locate the groundwater contamination from the Omega site.

It is the view of the authors that the limitations and data gaps do not compromise the conclusions. However, a variety of uncertainties must be taken into account when considering the strength of the conclusions, and making recommendations. The recommendations presented later in this document in the Public Health Recommendation and Action section are aimed at addressing the limitations described below.

PATHWAYS ANALYSES

This section addresses the pathways by which people in the area surrounding the site are exposed or may have been exposed to contaminants at, or migrating from, the site. If it is determined that exposure to chemicals not necessarily related to the site is also of concern, that exposure is evaluated as well.

When a chemical is released into the environment, the release does not always lead to exposure. Exposure only occurs when a chemical comes into contact with people and enters the body. In order for a chemical to pose a human health risk, a complete exposure pathway must exist.

A completed exposure pathway consists of five elements: 1) a source and a mechanism of chemical release to the environment; 2) a contaminated environmental medium such as air, soil, or water; 3) point where someone contacts the contaminated medium (known as the exposure point); 4) an exposure route such as, inhalation, dermal absorption, or ingestion; and 5) the person or people exposed (8).

Exposure pathways are classified as either completed, potential, or eliminated. In completed exposure pathways, all five elements exist. Potential exposure pathways are either: 1) not currently complete, but could become complete in the future, or 2) are indeterminate due to lack of information. Pathways are eliminated from further assessment if one or more element of exposure pathways is missing and is never likely to exist.

A time frame given for each pathway indicates whether the exposure occurred in the past, is occurring, or will occur in the future. For example, a completed pathway with only a past time frame indicates that exposure did occur in the past, but exposure is not occurring now and is not likely to occur in the future. The following discussions describe how people have been or may be exposed to contaminants. The health implications of the completed exposure pathways are discussed in the Public Health Implications section.

A. COMPLETED EXPOSURE PATHWAY

Based on the limited data, there are no completed exposure pathways.

B. POTENTIAL EXPOSURE PATHWAYS

Potential Future Exposure to Soil Contaminated with VOCs - On-Site Workers

Based on the subsurface soil investigations by England and Hargis and CDM, elevated concentrations of VOCs were detected in the subsurface soil at the Omega site. However, exposures to on-site soils would need to be of a chronic exposure period to see health effects. Additionally, the Omega site is paved with concrete and therefore it is unlikely that exposure will occur. It is possible that future construction at the Omega site may lead to contact with contaminated soils. However, these exposures would likely be one to two years of exposure and therefore are not likely to result in any adverse health effects.

Potential Current and Future Exposure to Soil Gas Contaminated with VOCs-Workers on the Omega Site

Based on the soil gas investigation conducted by England and Hargis, high concentrations of VOCs were detected in soil gas in several soil gas monitoring locations within the Omega site. Although it is not possible to directly assess the health impact based on the soil gas concentrations, these concentrations do suggest potential in-building air health impacts and the need for in-building air monitoring (Appendix C: Table 8). Because the warehouse, which has been leased for manufacturing purposes, is located on the Omega site potential soil gas migration into the in-building air may pose a health concern to workers in the warehouse. A Health Consultation will be issued to reflect any additional information that changes the conclusions of this PHA.

Potential Current and Future Exposure to Soil Gas Contaminated with VOCs-Residents and Workers in the Vicinity of the Omega Site

Based on the soil gas investigation conducted by England and Hargis, elevated concentrations of VOCs were detected in soil gas in several locations within, and at the boundary of, the Omega site. Although it is not possible to directly assess the health impact based on the soil gas concentrations, these concentrations suggest the potential for exposure to soil gas VOCs does exist. Because gases are very mobile, it is difficult to determine where soil gases will travel. Therefore, efforts to determine the potential health impacts from soil gases from the Omega site should incorporate ambient air monitoring at the boundary of the Omega site and in buildings on the Omega site (Appendix C: Table 8). If these efforts are non-detect for the COCs or are detected below health comparison values, then no further action should be necessary. However, if boundary and/or indoor air concentrations are of health concern, additional actions would need to be taken. A Health Consultation will be issued to reflect any additional information that changes the conclusions of this PHA.

Potential Future Exposure to Groundwater Contaminated with VOCs Via Municipal Water Systems- Citizens of the City of Santa Fe Springs

Based on the groundwater investigations conducted by England and Hargis, and Camp, Dresser and McKee (CDM), VOCs were detected in the groundwater on and off site. The contaminated groundwater plume migrating off the Omega site does not appear to have impacted the nearest operating downgradient municipal groundwater well, DWR #2S/11W-32G3, which belongs to and services the City of Santa Fe Springs (Appendix C: Table 8). Municipal water supply wells are routinely sampled for VOCs and a variety of other potential contaminants. Currently, the USEPA is taking actions to prevent the contaminated groundwater plume from impacting this municipal well. USEPA plans to identify the sources and areas of groundwater contamination and then identify and evaluate the cleanup options for the groundwater contamination problems (4). This information will be summarized in a Remedial Investigation/Feasibility Study (RI/FS) document (4). Remedial Investigation/Feasibility Study activities are currently under way. The drinking water from municipal well, DWR #02/11W-30R3S, is sampled on a regular basis to insure that the quality of the water meets California drinking water standards (3). However, because the ingestion and/or usage of contaminated groundwater may be a potential future health concern, we are evaluating the potential future health impact to citizens of the City of Santa Fe Springs.

Potential Past, Current, and Future Exposure to Groundwater Contaminated with VOCs Via Private Groundwater Wells - Off-Site Workers and Residents in the Vicinity of the Omega Site

Based on the groundwater investigations conducted by England and Hargis, and CDM, high concentrations of VOCs were detected in the groundwater on-site and off-site. According to the USEPA, there are no known private domestic groundwater water wells that are in use downgradient or in the vicinity of the Omega site (Appendix C: Table 8). The USEPA has stated that they plan to conduct a well survey of all the potential downgradient groundwater wells to confirm this (4). CDHS and ATSDR recommend that this effort be completed in the near future to ensure that there are no private wells extracting contaminated groundwater for potable uses. Thus, the ingestion and/or usage of contaminated groundwater may be a potential health concern.

C. ELIMINATED EXPOSURE PATHWAYS

Past, Current, and Future Exposure to the Groundwater Contaminated with VOCs - Via City of Whittier Municipal Water Systems - Workers on the Omega Site, Residents, and Workers in the Vicinity of the Omega Site

Based on the groundwater investigation conducted by England and Hargis, and CDM, elevated concentrations of VOCs were detected in the groundwater on-site and off site. The contaminated groundwater plume has not impacted any municipal groundwater wells serving the City of Whittier, therefore this pathway has been eliminated from further evaluation (Appendix C: Table 9). The groundwater wells belonging to the two municipal water suppliers for the City of Whittier are located in the City of Industry which is approximately 3.25 north of the City of Whittier. Since the contaminated groundwater plume is moving in a southwest direction, groundwater contamination at the Omega site does not and will not likely have any impact to the City of Whittier's drinking water system.

PUBLIC HEALTH IMPLICATIONS

A. TOXICOLOGICAL EVALUATION

In evaluating health effects, several factors determine whether harmful effects will occur and the type and severity of those health effects. These factors include the dose (how much), the duration (how long), the route by which people are exposed (breathing, eating, drinking, or skin contact), the other contaminants to which they may be exposed, and their individual characteristics such as age, sex, nutrition, family traits, life style and state of health.

In order to determine whether adverse health effects are possible as a result of exposure to a contaminant, an exposure dose must be estimated for each pathway. This exposure dose can then be compared with appropriate toxicity values in order to evaluate the likelihood of adverse health effects occurring. Toxicity values used to evaluate non-cancer adverse health effects include

ATSDR's Minimal Risk Level (MRL) and EPA's Reference Dose (RfD) for ingestion and Reference Concentration (RfC) for inhalation. These values are estimates of daily human exposure to a contaminant below which non-cancer, adverse health effects are unlikely to occur. Please see the Appendix B - Glossary for an in-depth discussion of the toxicity values.

The National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), and USEPA have reviewed available information from human and/or animal studies to determine whether certain chemicals are likely to cause cancer in humans. The potential for cancer to occur in an individual or a population is evaluated by estimating the probability of an individual developing cancer over a lifetime as the result of the exposure. EPA has developed cancer slope factor values for many carcinogens. A cancer slope factor is an estimate of a chemical's potential for causing cancer. Please see the Appendix B - Glossary for an in-depth discussion of the toxicity values for cancer.

In this section, we have included an analysis of the potential health impact, both non-cancer and cancer, to on-site and off-site workers, and near-by residents for groundwater and subsurface soil pathways. Also, general discussion about exposures to the contaminants detected in the subsurface soil and the groundwater is included in the Appendix D - Toxicological Profiles for Chemicals.

<u>Potential Current and Future Exposure to Soil Gas Contaminated with VOCs - Workers on the Omega Site and Workers and Residents in the Vicinity of the Omega Site</u>

Based on the soil gas investigations, VOCs were detected in the majority of locations sampled on the Omega site. The most prevalent and highest concentrations of VOCs include: Freon 113, Freon 11, 1,1,1-TCA and PCE (Appendix C: Tables 1 & 2). Based on the available data, we know that there are high concentrations of VOCs in the soil gas within the boundaries of the Omega site.

Using the Karimi model, which is a simple diffusion-based screening model, CDHS estimated the in-building air concentrations of PCE that may be caused by soil gases. The Karimi model uses a number of chemical and physical constants in calculating concentrations of gases in a building, based on soil gas data. This model may underestimate concentrations in a building resulting from convectional forces caused by heating the building interior and creating a suction effect on the soil gases causing them to enter the buildings. Heating the building will pull vapors up into the building from soils beneath the building footprint. The Karimi model also incorporates measured or investigated values that are site specific. In the case of the Omega site, CDHS used average PCE concentrations detected in soil gas from sample locations beneath the site building footprint. Other contaminants detected in soil gases were not incorporated into this model because chemical-specific vapor phase diffusion coefficients were not available for the contaminants of concern. The Karimi model predicted a significant concentration of PCE would diffuse into the site building. The model predicted the concentrations of PCE in the site building to be 7,930 ppb (ug/m^3). This is significantly greater than the chronic EMEG for PCE in air of 40 ppb (ug/m^3). See Appendix E for a summary of assumptions used in the Karimi Model. Based on our estimates, it appears that the contaminants in the soil gas may pose an in-building air concern. However, to determine if the VOC- contaminated soil gas has migrated into the buildings at concentrations that pose a health concern, in-building air monitoring is needed.

Elevated concentrations of VOCs were detected in the soil gas collected from several locations at the boundary of the Omega site. This may pose a health concern because soil gas contaminants can migrate and escape from the soil surface. Once liberated at the soil surface, the contaminants can enter buildings. Because of their construction characteristics, certain buildings tend to "trap" or "pull" soil gas contaminants into the structure. In this manner, soil gas contaminants can enter buildings, and people using the building can inhale the contaminants. While soil gas can be an important source of in-building air contaminants, it is only one of several contributors to the total air contaminants found inside a building. Other sources of indoor air contaminants include the chemicals contained in the outdoor air and the chemicals released into the building by the building components and contents. Furthermore, products (i.e., chemicals, cleaning solutions) used in the daily processes of tenant operations can contribute to the concentrations of contaminants in the indoor air.

Based on the proximity of the skating rink, immediately to the southwest of the Omega site, and the concentrations of soil gas contaminants detected at the site, CDHS has considered the potential for VOCs in soil gas to migrate towards the skating rink and the potential for those contaminants to migrate into the building through the foundation. Based on estimates for PCE migration into the Omega site buildings, CDHS believes that the migration of soil gas contaminants into off-site buildings is a possibility. However, the distribution of soil gas concentrations, particularly for PCE, at the Omega site appear to be localized near the former sump area in the southwestern portion of the site (Appendix A: Figure 7). This suggests that the likelihood of significant concentrations reaching the skating rink is remote. Nonetheless, the possibility does exist that soil gas contaminants from the Omega site could impact indoor air at the skating rink and, potentially, other off-site locations. Soil gas contaminants from the Omega site that migrate to the skating rink could affect the health of workers and visitors to the skating rink, most specifically children. At this time this pathway is considered a potentially completed pathway, due to limited data. In order to fully assess this pathway, ambient air monitoring data must be collected at least for the Omega site. Further ambient air monitoring may be needed if it is determined that air concentrations at the Omega site are of a health concern. If ambient air concentrations at Omega are not a health concern, then it is highly unlikely that soil gas contaminants will adversely impact the skating rink or other off-site locations.

The soil gas investigation provided valuable information concerning the level of VOCs in the soil. Additional information is necessary in order to fully assess the impact of the high level of VOCs in the soil gas beneath the Omega site. Specifically, an in-building air monitoring investigation is needed to determine if the soil gas has migrated into the on-site buildings and potentially to off-site buildings and businesses.

On-site Workers on the Omega Site - Potential Future Exposure to Soil Contaminated with VOCs

Based on the subsurface soil investigations by England and Hargis and CDM, elevated concentrations of VOCs were detected in the subsurface soil at the Omega site. However, exposures to on-site soils would need to be of a chronic exposure period to see health effects. Additionally, the Omega site is paved with concrete and therefore it is unlikely that exposure will occur. It is possible that future construction at the Omega site may lead to contact with contaminated soils. However, these exposures would likely be one to two years of exposure and therefore are not likely to result in any adverse health effects.

In order to estimate conservative non-cancer and cancer doses, we assumed that the concrete pavement was removed from the Omega site for a construction project that took two years to complete. CDHS estimated non-cancer ingestion doses for workers (i.e., PCE [0.000395 milligrams per kilograms per day (mg/kg/day)], antimony [0.0000055 mg/kg/day], arsenic [0.0000027 mg/kg/day], barium [0.000070 mg/kg/day], chromium [0.000064 mg/kg/day], nickel [0.0000167 mg/kg/day], and vanadium [0.000022 mg/kg/day]) based on the highest level of each contaminant detected in the subsurface soil. None of the adult non-cancer ingestion doses exceed ATSDR's MRLs or USEPA's RfDs, thus, non-cancer health effects are not expected for workers (i.e., namely, construction workers) who spend 10 hours/day, 5 days/week for a two-year long construction project on the Omega site.

Polycyclic aromatic hydrocarbons (PAHs) were detected in only one soil sample (SB-15 at 1.7' bgs) (1). Benzo(a)pyrene (1.6 parts per million (ppm)) was the only PAH detected that was above USEPA's preliminary remediation goals (PRGs), which are protective of public health. Because the site is paved, it is currently unlikely that workers would be exposed to these levels at the Omega site.

CDHS estimated the total increased lifetime excess cancer risk, 4×10^{-7}, for the three contaminants (i.e., PCE, benzo(a)pyrene, and arsenic) that are carcinogens via the ingestion route. This is considered to be a no apparent increased cancer risk to workers that may be exposed to contaminants in the subsurface soil during a construction and/or redevelopment project in the future.

We did not estimate non-cancer and cancer doses for the following contaminants: 1,1-DCE, methylene chloride, TCE, and toluene because these contaminants were detected in subsurface soil that was located in the loading dock sump which has been excavated and removed off-site. Thus, there are no potential current and/or future exposures to these contaminants.

Off-site Workers and Residents in the Vicinity of the Omega Site - Potential Exposure to Contaminants in the Groundwater Obtained from Private Wells

In order to estimate conservative non-cancer and cancer doses, we assumed that the concentrations of contaminants measured on-site could move off-site and eventually impact downgradient groundwater wells (i.e., private wells which may exist in the vicinity of the Omega site and one of the municipal wells, DWR #2S/11W-32G3, owned by the City of Santa Fe Springs). We assumed that a person ingested two liters per day of the contaminated groundwater for 30 years. This is being evaluated as a possible potential future scenario that could only occur if no remedial action of the contaminated groundwater is taken. This may be an overestimation of the toxicological evaluation for this future exposure pathway because as the contaminated groundwater plume moves, the plume will become more spread out which would result in the dilution of the contaminant concentrations. Additionally, there would probably be some degradation of the chemicals in the groundwater, thus, further lowering the concentrations of contaminants that would possibly ever reach the groundwater wells.

CDHS estimated non-cancer ingestion doses for adults (i.e., acetone [0.82 mg/kg/day], benzene [0.0021 mg/kg/day], chloroform [0.63 mg/kg/day], 1,1-DCE [0.19 mg/kg/day], 1,2-DCA [0.27 mg/kg/day], methylene chloride [4.11 mg/kg/day], PCE [2.36 mg/kg/day], toluene [0.080 mg/kg/day], TCE [0.17 mg/kg/day], 1,1,1-TCA [0.38 mg/kg/day], and trichlorofluoromethane [0.12 mg/kg/day]) based on the highest level of each contaminant detected in the groundwater. Five of the adult non-cancer doses (chloroform, 1,1-DCE, 1,2-DCA, methylene chloride, and PCE) exceed ATSDR's MRLs or USEPA's Reference Dose (RfD, Appendix B: Glossary), thus, requiring further evaluation if the contaminants measured in the groundwater on-site were detected in private groundwater wells (which may or may not exist in the vicinity of the Omega site) or ever reach the City of Santa Fe Spring's municipal groundwater well (i.e., DWR #2S/11W-32G3).

CDHS also estimated non-cancer ingestion doses for children (i.e., acetone [1.8 mg/kg/day], benzene [0.00449 mg/kg/day], chloroform [1.38 mg/kg/day], 1,1-DCE [0.414 mg/kg/day], 1,2-DCA [0.599 mg/kg/day], methylene chloride [8.99 mg/kg/day], PCE [5.15 mg/kg/day], toluene [0.174 mg/kg/day], TCE [0.378 mg/kg/day], 1,1,1-TCA [0.839 mg/kg/day], and trichlorofluoromethane [0.258 mg/kg/day]) based on the highest level of each contaminant detected in the groundwater. All of the child non-cancer doses (benzene, chloroform, 1,1-DCE, 1,2-DCA, methylene chloride, PCE, TCE, and 1,1,1-TCA) exceed ATSDR's MRLs or USEPA's RfDs, thus, non-cancer health effects could occur to children if the contaminants measured in the groundwater on-site were detected in private groundwater wells.

CDHS estimated the total increased lifetime excess cancer risk, 7.4×10^{-2}, for the following contaminants (i.e., benzene, chloroform, 1,1-DCE, 1,2-DCA, and methylene chloride) which are considered to be carcinogenic. This is considered a high increased cancer risk. This high increased cancer risk would be predicted if the contaminants in the groundwater on-site ever impacted these groundwater wells.

B. COMMUNITY HEALTH CONCERNS EVALUATION

Q: Are there any health implications from the contaminated soil or soil gas?

A: The Omega site is paved with concrete. There are no health impacts because no one is exposed to the contaminated soil. Based on the limited available data, the inhalation of soil gas is a potential health concern.

Q: Can odors that have been smelled at Kaiser Permanente be coming from the Omega Site and can they be harmful?

A: Based on the limited data it is difficult to assess whether there is off-site migration of soil gas from the Omega site. CDHS has recommended that USEPA conduct an ambient air survey around the border of the Omega site to determine the health risk to potential soil gas migration. According to USEPA, the source of the odor problem may be from a metal fence galvanizing facility located on Putnam Street (4). CDHS has been in contact with the South Coast Air Quality Management District (SCAQMD) regarding this matter (personal communication with Lynn Brown of SCAQMD on 4/25/01). According to Ms. Lynn Brown project manager for the Merchant Metals facility located at 12482 East Putnam Drive in Whittier, the facility is currently in compliance with all applicable air quality regulations. Ms. Brown indicated that SCAQMD is in the process of determining what chemicals are causing the odor problems and working with Merchant Metals to resolve the odor problems.

ATSDR CHILD HEALTH INITIATIVE

ATSDR recognizes that infants and children may be more sensitive to exposures, depending on substance and the exposure situation, than adults in communities with contamination of their water, soil, air, and/or food. This sensitivity is a result of several factors: 1) Children may have greater exposures to environmental toxicants than adults because pound for pound of body weight, children drink more water, eat more food, and breathe more air than adults; 2) Children play outdoors close to the ground which increases their exposure to toxicants in dust, soil, surface water, and in the ambient air; 3) Children have a tendency to stick their hands in their mouths while playing without washing their hands, thus, they may come into contact with, and ingest, potentially contaminated soil particles at higher rates than adults (also, some children possess a behavior trait known as "pica" which causes them to ingest non-food items, such as soil); 4) Children are shorter than adults, which means they can breathe dust, soil, and any vapors close to the ground; 5) Children's bodies are rapidly growing and developing; thus, they can sustain permanent damage if toxic exposures occur during critical growth stages; and 6) Children and teenagers may disregard no trespassing signs and wander onto restricted locations. Because children depend completely on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests at sites such as the Omega site as part of the ATSDR Child Health Initiative.

CDHS has attempted to identify places (e.g., parks, schools, recreational facilities) in the vicinity of the Omega site where children spend time (i.e., live, play, or go to school). The location closest to the Omega site where children may spend time is at a skating rink that abuts the Omega site to the south (less than 100 feet away). For the reasons described previously, on-site soil and groundwater do not represent a public health hazard for children at this time. However, soil gas migration from the Omega site may pose a health concern for children due to the proximity of the skating rink. CDHS plans to revisit the Omega site and issue a Health Consultation if the additional environmental data show that the Omega site poses a public health hazard. Off-site groundwater contamination is a potential future exposure source for children if contamination from the Omega site gets into the municipal water supply.

CONCLUSIONS

Based on the information reviewed, the California Department of Health Services (CDHS) and the Agency for Toxic Substances and Disease Registry (ATSDR) conclude that the Omega site poses an indeterminate public health hazard to on-site workers and residents and off-site workers in the vicinity of the Omega site.

Based on the limited data, CDHS determined that there are no completed exposure pathways. CDHS identified two potential exposure pathways: breathing soil gas, and drinking groundwater.

According to the limited soil gas data collected by England and Hargis and CDM, high concentrations of VOCs were detected in the soil gas in several soil gas monitoring locations within the Omega site. Although it is not possible to directly assess the health impacts based on the soil gas concentrations, they do suggest potential in-building air health concerns to individuals both on and, in the vicinity of, the site. Thus, the soil gas poses a potential public health concern.

Based on the groundwater investigations conducted by England and Hargis, and CDM, high concentrations of VOCs were detected in the groundwater on- and off-site. To date, the contaminated groundwater plume migrating off the Omega site has not impacted the nearest operating downgradient municipal groundwater well which is owned by the City of Santa Fe Springs. This municipal well serves the citizens of the City of Santa Fe Springs. Currently, USEPA is installing sentinel wells downgradient of the Omega site in an attempt to prevent this plume from impacting the City of Santa Fe Springs' municipal well. USEPA has plans to implement additional RI/FS activities in the summer of 2001. However, if USEPA's efforts to treat contamination from the Omega site are not successful, the groundwater plume could impact the municipal well and pose a potential health impact to the citizens of the City of Santa Fe Springs.

According to the USEPA, there are no known private domestic groundwater wells that are in use downgradient or in the vicinity of the Omega site. USEPA has indicated that they plan to conduct a well survey to confirm this. Therefore, the ingestion and/or usage of contaminated groundwater may be a potential exposure pathway. Since CDHS has determined that the contaminated groundwater may pose a future public health concern to individuals exposed to contaminated groundwater, we estimated both non-cancer and cancer doses. Several of the estimated non-cancer doses exceed ATSDR's MRLs, thus, non-cancer health effects could occur if the contaminants measured in the groundwater on-site were detected in the private groundwater wells or in the City of Santa Fe Spring's municipal well. Also, CDHS estimated the cancer risk for the contaminants that are carcinogens via the ingestion route and determined that a high increased cancer risk is predicted if the contaminants in the groundwater on-site ever impacted these groundwater wells.

The contaminated groundwater from the Omega site does not pose a past, current, or future health concern to the citizens of the City of Whittier. The municipal groundwater wells that belong to the two municipal water suppliers for the City of Whittier are located in the City of Industry, which is located approximately 3.25 miles north of the City of Whittier. Since the contaminated groundwater plume is migrating off the Omega site in a southwesterly direction, it has and will not likely have any impact to the City of Whittier's municipal water supply.

Based on the available environmental data reviewed and evaluated, the Omega site poses an indeterminate public health hazard. Currently, USEPA is providing environmental oversight and remediation at the Omega site, CDHS believes that if these remedial activities are successful the site will not impact the health of individuals living and working in the vicinity of the Omega site.

PUBLIC HEALTH RECOMMENDATIONS AND ACTIONS

A. Actions Completed

1. England and Hargis, contractors for the responsible parties, have completed the Phase I investigation which involved the removal of drums, containers, and debris from the Omega site.

2. England and Hargis, contractors for the responsible parties, have completed the Phase II investigation which involved the collection and analysis of soil gas, soil, and groundwater on the Omega site.

3. CDM completed a draft Phase 1a Pre-design Field Investigation Report for the Omega site.

B. Actions Planned

1. USEPA plans to perform a risk assessment for the Omega site.

2. USEPA plans to conduct an updated well survey of all potential groundwater

wells downgradient of the Omega site.

3. USEPA is in the process of installing and developing sentinel wells downgradient of the Omega site to track the groundwater contamination from the Omega site.

4. USEPA plans to conduct a remedial investigation and feasibility study for the Omega facility.

5. USEPA plans to conduct a remedial investigation and feasibility study for areas downgradient of the Omega site.

C. Recommendation for Further Actions

1. CDHS recommends that indoor air monitoring for on-site buildings at the Omega site be conducted by USEPA to determine air levels of site-related contaminants. CDHS will evaluate this data to assess the public health implications of this pathway.

2. CDHS recommends that USEPA install soil gas probes, at various depths below ground surface, along the perimeter of the Omega site to determine the extent of soil gas migration in the horizontal direction.

3. CDHS recommends that municipal well, DWR #2S/11W-32G3, which belongs to and services the City of Santa Fe Springs, be monitored regularly by the California Department of Drinking Water to ensure that Omega site contaminants do not impact this municipal groundwater well.

4. CDHS recommends that USEPA undertake a private well survey of the area downgradient of the site to determine if individuals or businesses are using private well water for potable purposes.

5. CDHS recommends continued downgradient groundwater monitoring to ensure contamination from the Omega site does not impact municipal water supply wells.

6. CDHS recommends that USEPA make efforts to contain and remediate groundwater contamination from the Omega site and to determine the vertical and horizontal extent of contamination.

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Certification

This Omega Chemical Public Health Assessment was prepared by the California Department of Health Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment and concurs with the findings.

for Richard Gillig
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APPENDIX A - FIGURES

Figure 1: Regional Site Location [1]

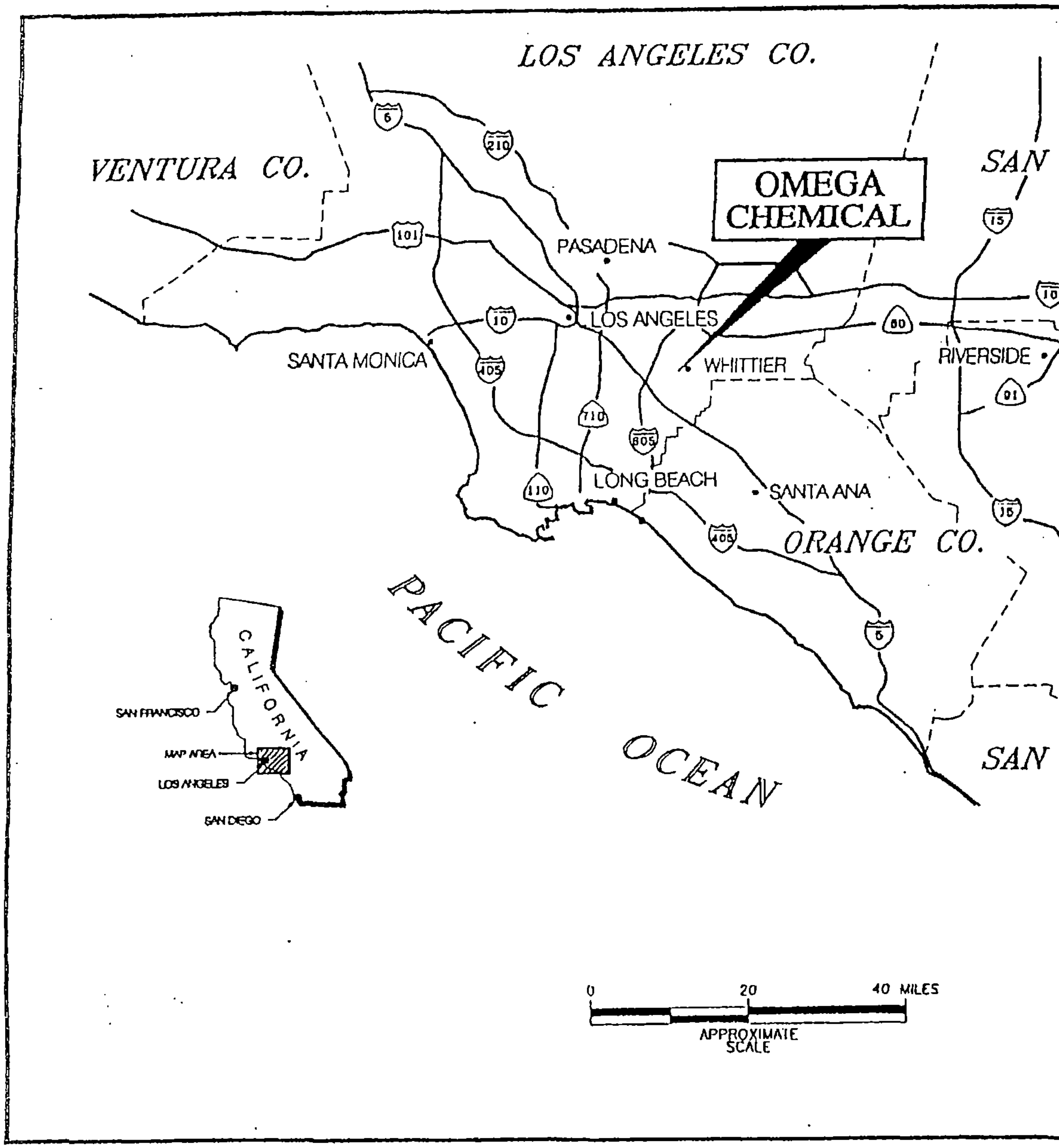


FIGURE 1

REGIONAL SITE LOCATION

OMEGA CHEMICAL
WHITTIER, CALIFORNIA

PREPARED FOR
OPOG

ENGLAND & ASSOCIATES
HARGIS + ASSOCIATES, INC.

Figure 2: Omega Site Location Map (1)

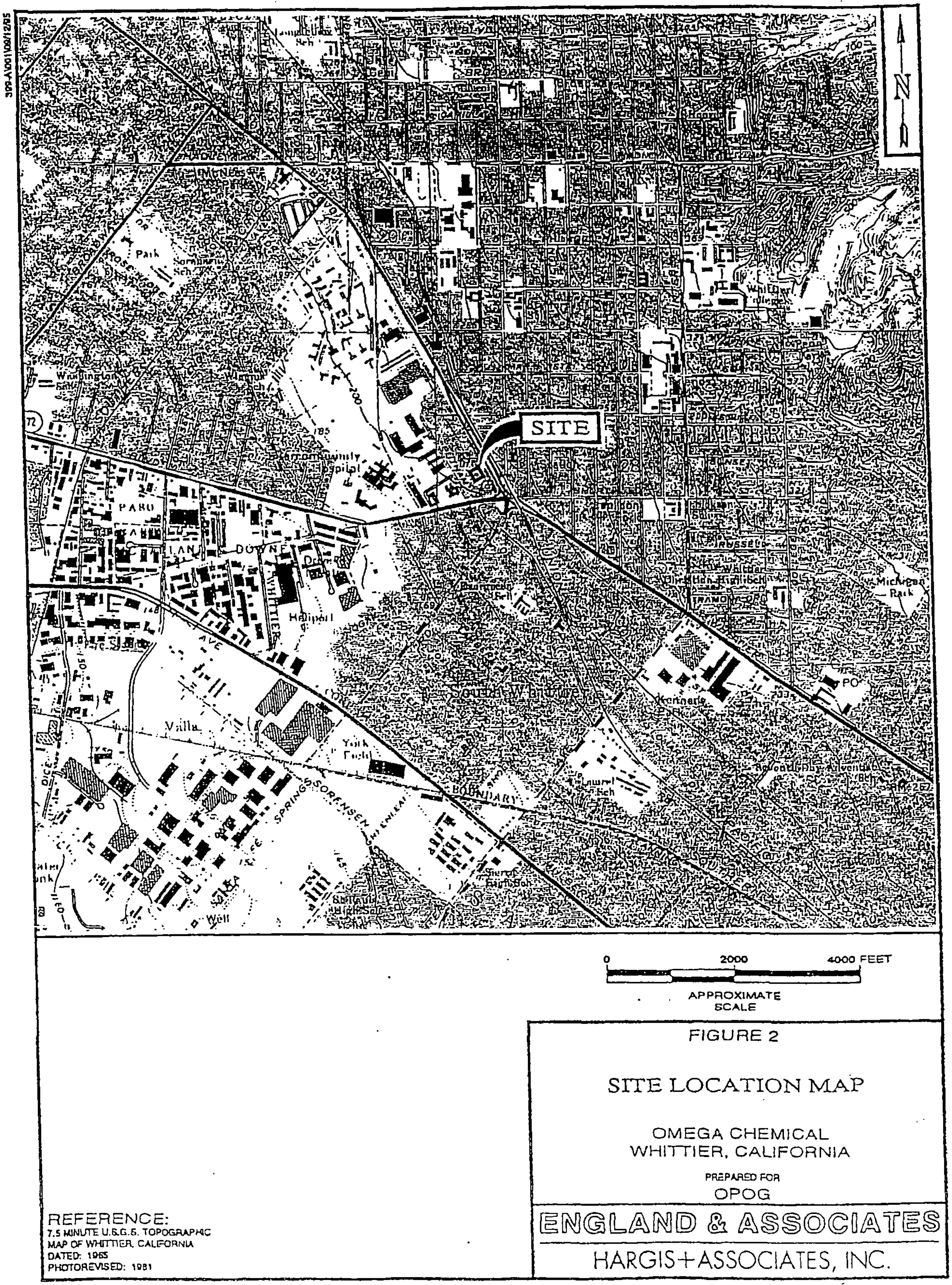


Figure 3: Figure Depicting Industries in the Vicinity of the Omega Site [1]

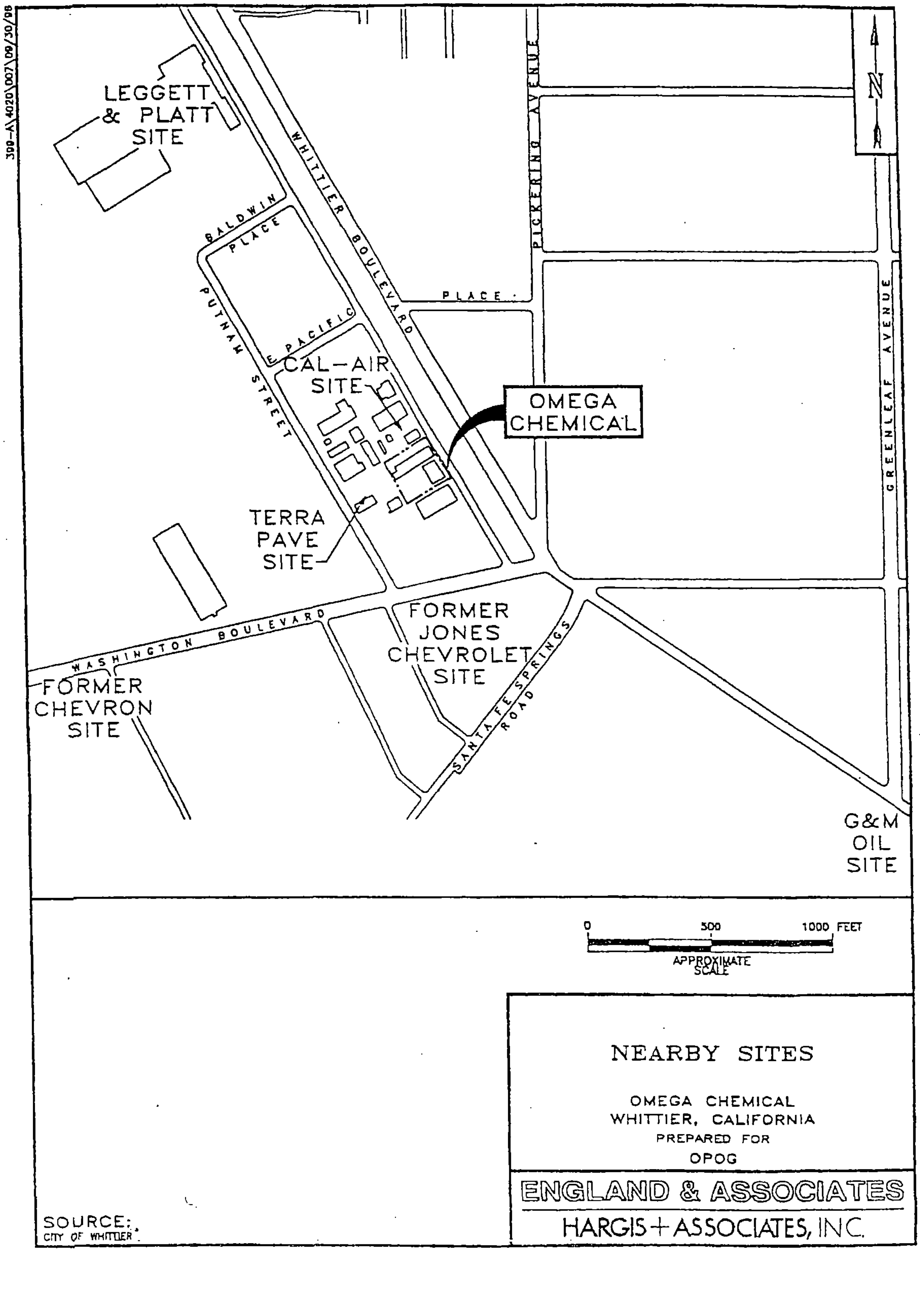


Figure 4: Soil Gas Sampling Locations [1]

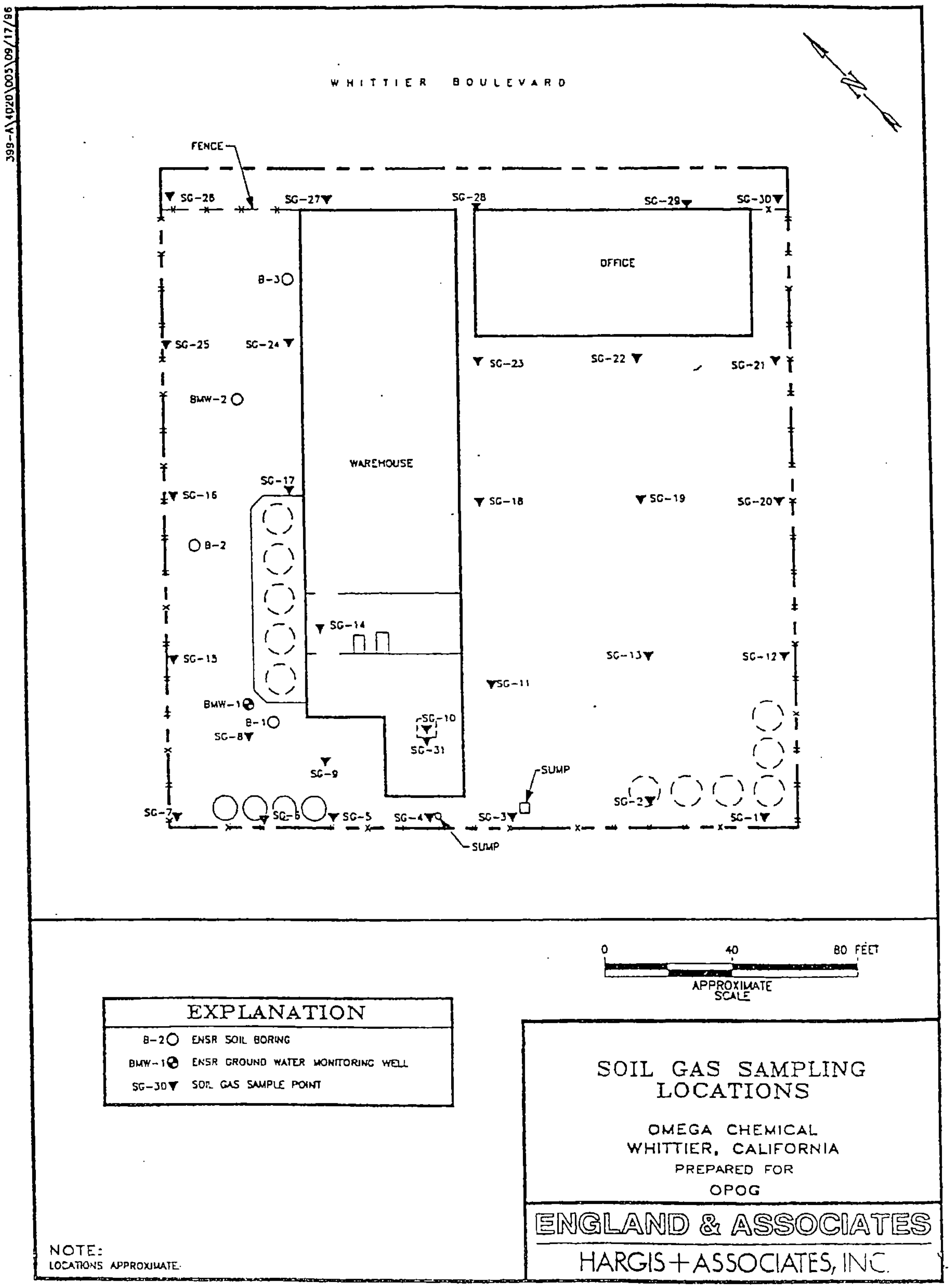


Figure 5: Subsurface Soil Boring Locations (1)

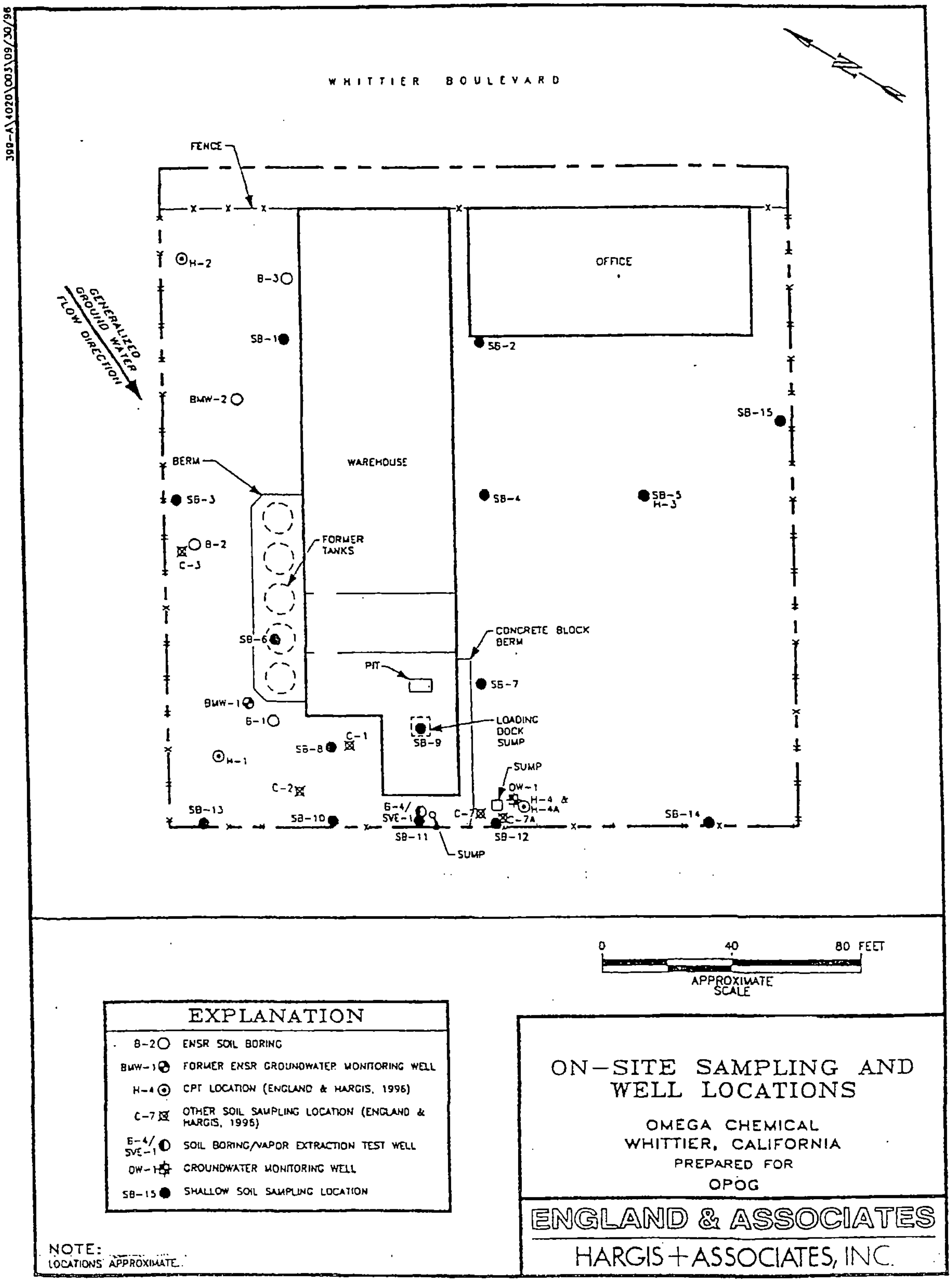
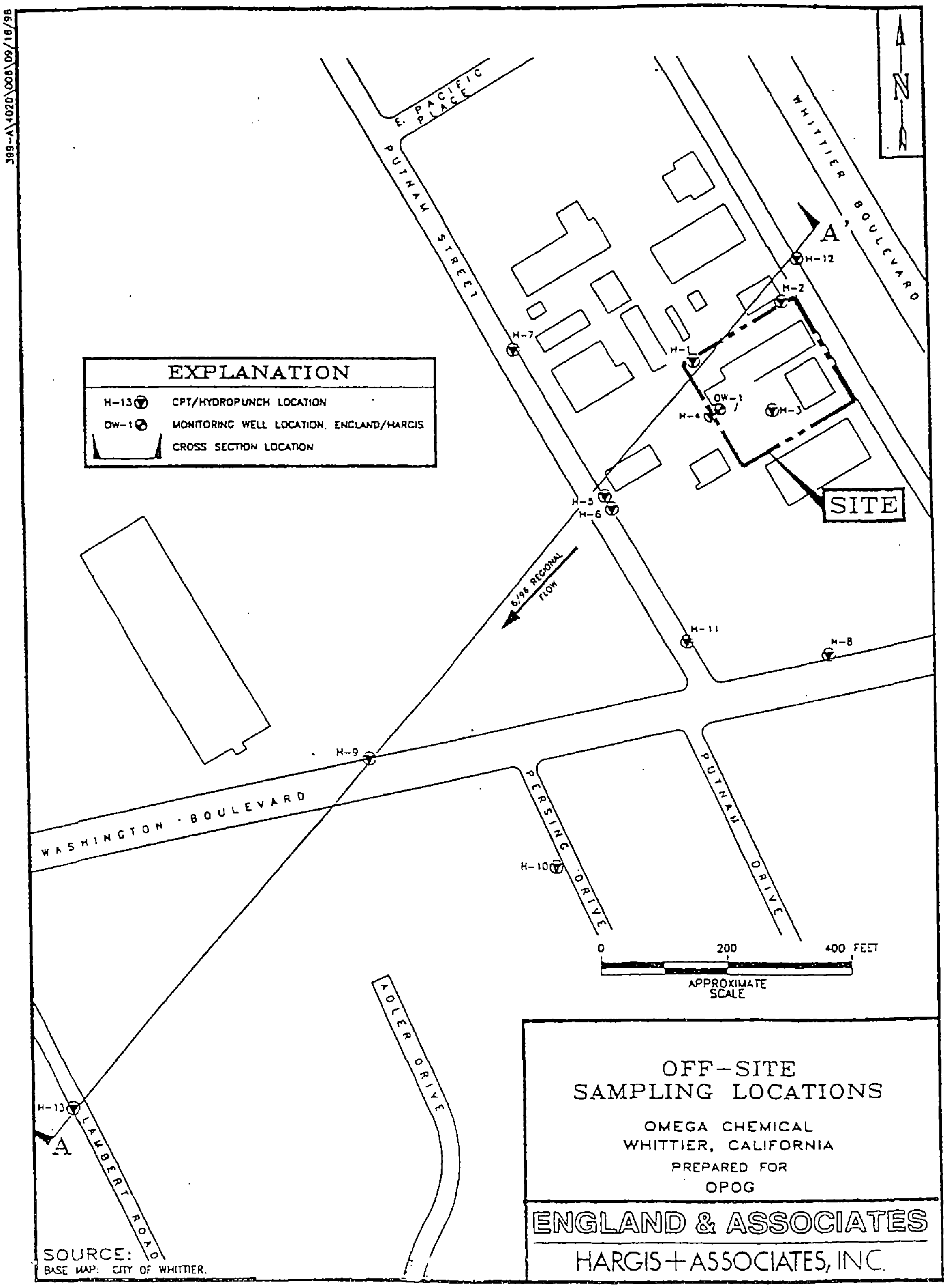


Figure 6: Groundwater Sampling Locations (1)



APPENDIX B: GLOSSARY

Absorption
How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.

Acute Exposure
Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Adverse Health Effect
A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR
The Agency for **T**oxic **S**ubstances and **D**isease **R**egistry. ATSDR is a federal health agency in Atlanta, Georgia, that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Level
An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific-environment.

Cancer Risk
The potential for exposure to a contaminant to cause cancer in an individual or population is evaluated by estimating the probability of an individual developing cancer over a lifetime as the result of the exposure. This approach is based on the assumption that there are no absolutely "safe" toxicity values for carcinogens. USEPA has developed cancer slope factors for many carcinogens. A slope factor is an estimate of a chemical's carcinogenic potency, or potential, for causing cancer.

If adequate information about the level of exposure, frequency of exposure, and length of exposure to a particular carcinogen is available, an estimate of excess cancer risk associated with the exposure can be calculated using the slope factor for that carcinogen. Specifically, to obtain risk estimates, the estimated, chronic exposure dose (which is averaged over a lifetime or 70 years) is multiplied by the slope factor for that carcinogen.

Cancer risk is the likelihood, or chance of getting cancer. We say "excess cancer risk" because we have a "background risk" of about one-in-four chances of getting cancer. In other words, in a million people, it is expected that 250,000 individuals would get cancer from a variety of causes. If we say that there is a "one-in-a-million" excess cancer risk from a given exposure to a contaminant, we mean that if one million people are exposed to a carcinogen at a certain level over their lifetime, then one cancer above the background chance, or the 250,000st cancer, may appear in those million persons from that particular exposure. In order to take into account the uncertainties in the science, the risk numbers used are plausible upper limits of the actual risk based on conservative assumptions. In actuality, the risk is probably somewhat lower than calculated, and, in fact, may be zero.

Cancer Risk Evaluation Guide (CREG)
Carcinogenic chemicals are selected for follow-up by comparing the concentrations to the CREG (8). CREGs are derived from USEPA cancer slope factors. Cancer slope factors give an indication of the relative carcinogenic potency of a particular chemical. CREG values represent media concentrations which are thought to be associated with an extra lifetime cancer risk of one-in-a-million.

CERCLA
See **C**omprehensive **E**nvironmental **R**esponse, **C**ompensation, and **L**iability **A**ct.

Chronic Exposure
A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be *chronic*.

Completed Exposure Pathway
See Exposure Pathway.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
CERCLA was put into place in 1980. It is also known as Superfund. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern
A belief or worry that chemicals in the environment might cause harm to people.

Concentration
How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant
See Environmental Contaminant.

Dermal Contact
A chemical getting onto your skin. (see Route of Exposure).

Dose
The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as "amount of substance(s) per body weight per day".

Dose / Response
The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration
The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant
A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in Background Level, or what would be expected.

Environmental Media
Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. Environmental Media is the second part of an Exposure Pathway.

Environmental Media Evaluation Guide (EMEG)
EMEGs are media specific values developed by ATSDR to serve as an aid in selecting environmental contaminants that need to be further evaluated for potential health impacts (8). EMEGs are based on non-carcinogenic end-points and do not consider carcinogenic effects. EMEGs are based on the MRLs.

Exposure
Coming into contact with a chemical substance. (For the three ways people can come in contact with substances, see Route of Exposure.)

Exposure Assessment
The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway
A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.

ATSDR defines an exposure pathway as having 5 parts:

1. Source of Contamination,
2. Environmental Media and Transport Mechanism,
3. Point of Exposure,
4. Route of Exposure, and
5. Receptor Population.

When all 5 parts of an exposure pathway are present, it is called a Completed Exposure Pathway.

Frequency
How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.

Hazardous Waste
Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Effect
ATSDR deals only with Adverse Health Effects (see definition in this Glossary).

Indeterminate Public Health Hazard
The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.

Ingestion
Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See Route of Exposure).

Inhalation
Breathing. It is a way a chemical can enter your body (See Route of Exposure).

LOAEL
Lowest **O**bserved **A**dverse **E**ffect **L**evel. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.

Maximum Contaminant Level (MCL)
The USEPA has issued drinking water standards, or MCLs for more than 80 contaminants in drinking water (24). The MCLs are set based on known or anticipated adverse human health effects (which also account for sensitive subgroups, such as, children, pregnant women, the elderly, etc.), the ability of various technologies to remove the contaminant, their effectiveness, and cost of treatment (24). For cancer risk, USEPA generally sets the MCLs at concentrations that will limit an individual risk of cancer from a contaminant to between 1 in 10,000 (low increased excess risk) to 1 in 1,000,000 (no apparent increased excess risk) over a lifetime (24). As for non-cancer effects, USEPA estimates an exposure level below which no adverse health effects are expected to occur.

Non-Cancer Evaluation = ATSDR's Minimal Risk Level (MRL) and USEPA's Reference Dose (RfD) and Reference Concentration (RfC)

The MRL, RfD and RfC are estimates of daily exposure to the human population (including sensitive subgroups), below which non-cancer adverse health effects are unlikely to occur. The

MRL, RfD and RfC only consider non-cancer effects. Because they are based only on information currently available, some uncertainty is always associated with the MRL, RfD, and RfC. "Safety" factors are used to account for the uncertainty in our knowledge about their danger. The greater the uncertainty, the greater the "safety" factor and the lower the MRL, RfD, or RfC.

When there is adequate information from animal or human studies, MRLs and RfDs are developed for the ingestion exposure pathway, whereas, RfCs are developed for the inhalation exposure pathway. A MRL, RfD or RfC is an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse (non-carcinogenic) health effects over a specified duration of exposure. No toxicity values exist for exposure by skin contact. Separate non-cancer toxicity values are also developed for different durations of exposure. ATSDR develops MRLs for acute exposures (less than 14 days), intermediate exposures (from 15 to 364 days), and for chronic exposures (greater than one year). USEPA develops RfDs and RfCs for chronic exposures (greater than seven years). Both the MRL and RfD for ingestion are expressed in units of milligrams of contaminant per kilograms body weight per day (mg/kg/day). The RfC for inhalation is expressed in units of mg/m^3 .

Non-Cancer and Cancer Evaluations = USEPA's Preliminary Remediation Goals (PRGs)
PRGs are developed by the USEPA to estimate contaminant concentrations in the environmental media (soil, air, and water), both in residential and industrial settings, that are protective of humans, including sensitive groups, over a lifetime (6). PRGs were developed for both industrial and residential settings because of the different exposure parameters, such as, different exposure time frames (e.g., industrial setting: workers are exposed for 8 hours/day and 5 days/week vs. residential setting: families are exposed 24 hours/day and 7 days/week; and different "human" exposure points (e.g., industrial setting: healthy adult males vs. residential setting: males, females, young children, and infants), etc. Media concentrations less than the PRGs are unlikely to pose a health threat; whereas, concentrations exceeding a PRG do not automatically determine that a health threat exists, but suggest that further evaluation is necessary.

NPL
The National Priorities List. (Which is part of Superfund.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

NOAEL
No Observed Adverse Effect Level. The highest dose of a chemical in a study, or group of studies, that did not cause harmful health effects in people or animals.

No Apparent Public Health Hazard
The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at concentrations expected to cause adverse health effects.

No Public Health Hazard
The category is used in ATSDR's Public Health Assessment documents for sites where there is evidence of an absence of exposure to site-related chemicals.

Permissible Exposure Limits (PEL)
PELs are established by the California Occupational Safety and Health Administration (CAL/OSHA) to ensure worker safety from exposure to potentially hazardous chemicals in occupational and industrial settings. PELs are enforceable legal limits that must not be exceed during any 8-hour work shift of a 40-hour work week (8). The PELs were set to ensure worker safety (i.e., healthy males) and may not be protective of sensitive groups, such as, pregnant women, children, the elderly, etc.

PHA
Public **H**ealth **A**ssessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Plume
A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure
The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). For examples: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population
A group of people living in a certain area; or the number of people in a certain area.

PRP:
Potentially **R**esponsible **P**arty. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

Public Health Assessment(s)
See PHA.

Public Health Hazard
The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria
PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each are defined in the Glossary. The categories are:
1. Urgent Public Health Hazard
2. Public Health Hazard
3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

Receptor Population
People who live or work in the path of one or more chemicals, and who could come into contact with them (See Exposure Pathway).

Reference Dose based Media Evaluation Guide (RMEG)
RMEGs are equivalent to EMEGs, but are derived from USEPA RfDs instead of ATSDR's MRLs (8).

RfD
An estimate of daily exposure of the human population to a potential hazard that is likely to be without risk of deleterious effects during a lifetime. The RfD is operationally derived from the NOAEL (from animal and human studies) by a consistent application of uncertainty factors that reflects various types of data used to estimate RfDs and an additional modifying factor, which is based on a professional judgement of the entire data base on the chemical. The RfDs are not applicable to non-threshold effects such as cancer.

Route of Exposure
The way a chemical can get into a person's body. There are three exposure routes:
- breathing (also called inhalation),
- eating or drinking (also called ingestion), and
- or getting something on the skin (also called dermal contact).

Safety Factor
Also called Uncertainty Factor. When scientists don't have enough information to decide if an exposure will cause harm to people, they use "safety factors" and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is not likely to cause harm to people.

Source (of Contamination)
The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an Exposure Pathway.

Special Populations
People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Superfund Site
See **NPL.**

Toxic
Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology
The study of the harmful effects of chemicals on humans or animals.

Uncertainty Factor
See Safety Factor.

Urgent Public Health Hazard
This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.

APPENDIX C - TABLES

Table 1: Summary of the Omega site Shallow Soil Gas Investigation

Soil Gas Location and Depth	Total Vapor Concentration (ppmv)
SG-1-6.0'	0
SG-1-12.0'	0
SG-2-6.0'	311
SG-2-12.0'	308
SG-3-6.0'	150
SG-3D-6.0	129
SG-3-12.0'	551
SG-4-6.0'	1,164
SG-4-12.0'	1,479
SG-4-16.7'	0
SG-5-6.0'	1,034
SG-5-12.0'	1,145
SG-6-6.0'	208
SG-6-12.0'	366
SG-7-6.0'	223
SG-7-12.0'	430
SG-8-6.0'	0
SG-8-12.0'	226
SG-9-6.0'	1,470
SG-9-12.0'	1,344
SG-9D-12.0'	1,470
SG-10R-6.0'	214,783
SG-10-6.0'	2,059
SG-11-6.0'	887
SG-11-12.0'	1,574

SG-1-6.0' = Sample location number - Depth of sample; ppmv = parts per million by volume
Total Vapor = Freon-12; trichlorofluoromethane; dichloromethane; trans-1,2-DCE; 1,1-DCA; cis-1,2-DCE; chloroform; 1,1,1-TCA; 1,2-DCA; TCE; PCE; 1,1-DCE; Freon-113; benzene; toluene; ethyl benzene; m,p-xylenes; and o-xylene.

Table 1 (continue): Summary of the Omega site Shallow Soil Gas Investigation

Soil Gas Location and Depth	Total Vapor Concentration (ppmv)
SG-11D-12.0'	1,463
SG-12-6.0'	3
SG-12-12.0'	270
SG-13-6.0'	1,162
SG-13-12.0'	529
SG-14-6.0'	9
SG-14-12.0'	1,106
SG-15-6.0'	0
SG-15-12.0'	0
SG-16-6.0'	1,464
SG-16-12.0'	1,202
SG-16-24.0'	94
SG-17-6.0'	1,266
SG-17-12.0'	1,110
SG-18-6.0'	1,462
SG-18-12.0'	465
SG-19-6.0'	925
SG-19-12.0'	2,158
SG-19-24.0'	46
SG-19-24.0'	46
SG-20-6.0'	602
SG-20-12.0'	3
SG-20D-12.0'	261

SG-1-6.0' = Sample location number - Depth of sample; ppmv = parts per million by volume
Total Vapor = Freon-12; trichlorofluoromethane; dichloromethane; trans-1,2-DCE; 1,1-DCA; cis-1,2-DCE; chloroform; 1,1,1-TCA; 1,2-DCA; TCE; PCE; 1,1-DCE; Freon-113; benzene; toluene; ethyl benzene; m,p-xylenes; and o-xylene.

Table 1 (continue): Summary of the Omega site Shallow Soil Gas Investigation

Soil Gas Location and Depth	Total Vapor Concentration (ppmv)
SG-21-6.0'	478
SG-21-12.0'	1,239
SG-22-6.0'	1,035
SG-22-12.0'	117
SG-23-6.0'	1,193
SG-23-12.0'	210
SG-24-6.0'	1,063
SG-24-12.0'	1,015
SG-25-6.0'	2
SG-25-12.0'	0
SG-26-6.0'	123
SG-26-12.0'	30
SG-26D-12.0'	28
SG-27-6.0'	6
SG-27-12.0'	19
SG-28-6.0'	233
SG-28-12.0'	44
SG-29-6.0'	115
SG-29-12.0'	99
SG-30-6.0'	334
SG-30-12.0'	2
SG-31-3.5'	0

SG-1-6.0' = Sample location number - Depth of sample; ppmv = parts per million by volume
Total Vapor = Freon-12; trichlorofluoromethane; dichloromethane; trans-1,2-DCE; 1,1-DCA; cis-1,2-DCE; chloroform; 1,1,1-TCA; 1,2-DCA; TCE; PCE; 1,1-DCE; Freon-113; benzene; toluene; ethyl benzene; m,p-xylenes; and o-xylene.

Table 2: Maximum Level of Contaminants Detected in the Subsurface Soil

Contaminant	Maximum Level (mg/kg)	Health Comparison Value (mg/kg)/Source
Antimony	18	0.8 (ATSDR's RMEG for pica child)
Arsenic	9	0.6 (ATSDR's chronic EMEG for pica child)
Barium	230	100 (ATSDR's RMEG for pica child)
Chromium	210	6 (ATSDR's RMEG for pica child)
Nickel	55	40 (ATSDR's RMEG for pica child)
PCE	260	20 (ATSDR's RMEG for pica child)
Vanadium	67	6 (ATSDR's intermediate EMEG for pica child)

Table 3: Maximum Level of Contaminants Detected in the Groundwater

Contaminant	Maximum Level (mg/kg)	Health Comparison Value (mg/kg)/Source
Acetone	30	20 (ATSDR intermediate EMEG for child)
Benzene	0.075	0.001(ATSDR's CREG)
Chloroform	23	0.006 (ATSDR's CREG)
1,1-DCE	6.9	0.00006 (ATSDR's CREG)
1,2-DCA	10	0.0004 (ATSDR's CREG)
Methylene chloride	150	0.005 (ATSDR's CREG)
PCE	86	0.1(ATSDR RMEG for child)
Toluene	2.9	0.2 (ATSDR intermediate EMEG for child)
TCE	6.3	0.005 (USEPA's MCL)
1,1,1-TCA	14	0.2 (USEPA's Lifetime Health Advisory for drinking water)
Trichlorofluoromethane	4.3	3 (ATSDR's RMEG for child)

Table 4: List of Metals Analytes

Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Mercury
Molybdenum
Nickel
Selenium
Thallium
Vanadium
Zinc

Table 5: List of Volatile Organic Compounds (VOCs) Analytes

Acetone
Acrolein
Acrylonitrile
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon disulfide
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
cis-1,2-dichloroethene
cis-1,3-dichloropropene
dibromochloromethane
Ethylbenzene
Freon 113
Methyl ethyl ketone
Methyl isobutyl ketone
Methylene chloride
Styrene
Tetrachloroethene
Toluene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
Trichloroethene
Trichlorofluoromethane
Vinyl acetate
Vinyl chloride
o-Xylene
m-Xylene
p-Xylene

Table 6: List of Semivolatile Organic Compounds (SVOCs) Analytes

Acenaphthene
Acenaphthylene
Aniline
Anthracene
Benzidine
Benz[a]anthracene
Benzo[a]pyrene
Benzo[b]fluoranthene
Benzo[g,h,i]perylene
Benzo[k]fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Benzoic acid
Benzyl alcohol
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
Bis(2-chloroisopropyl)ether
Bis(2-ethylhexyl)phthalate
Butylbenzylphthalate
Chrysene 218-01-9
Dibenz[a,h]anthracene
Dibenzofuran
Dibutylphthalate
Diethylphthalate
Dimethylphthalate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Indeno(1,2,3-cd)pyrene
Isophorone
N-Nitrosodi-n-propylamine
N-Nitrosodimethylamine
N-Nitrosodiphenylamine
Naphthalene
Nitrobenzene
Pentachlorophenol
Phenanthrene
Phenol
Pyrene
Pyridine
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Diphenylhydrazine
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methyl-4,6-dinitrophenol
2-Methylnaphthalene
2-Methylphenol
2-Nitroaniline
2-Nitrophenol
3,3'-Dichlorobenzidine
3-Nitroaniline4-Bromophenylphenylether
4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenylphenylether
4-Methylphenol
4-Nitroaniline
4-Nitrophenol

Table 7: List of Chlorinated Pesticides and Polychlorinated Biphenyls (PCBs) Analytes

Aldrin
Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
Benzene hexachloride (BHC)
BHC, alpha isomer
BHC, beta isomer
BHC, delta isomer
BHC, gamma isomer
(Lindane)
Chlordane
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
Methoxychlor
p,p'-DDD
p,p'-DDE
p,p'-DDT
Toxaphene

Table 8: Elements of Potential Exposure Pathways

Source	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Populations	Time Frame
Omega Site	Soil gas	On-site workers in the warehouse or the office building located on the Omega site. And Off-site workers, recreational users of Skateland, and residents in the vicinity of the Omega site	Inhalation	On-site and Off-site Workers, Recreational Users of Skateland, and Residents	Current and future
Omega Site	Groundwater from the City of Santa Fe Springs municipal groundwater well	Off-site workers and residents in the City of Santa Fe Springs	Skin absorption, incidental ingestion, and inhalation	Off-site Workers and Residents	Future
Omega Site	Groundwater from private groundwater well	Off-site workers and residents in the City of Whittier.	Skin absorption, incidental ingestion, and inhalation	Off-site Workers and Residents	Past, current, and future

Table 9: Elements of Eliminated Exposure Pathways

Source	Environmental Medium	Point of Exposure	Route of Exposure	Route of Exposure	Time Frame
Groundwater	Groundwater	On-site workers in the warehouse or the office building located on the Omega site and off-site workers and residents in the vicinity of the Omega site served by the City of Whittier Municipal water system	Skin absorption, incidental ingestion, and inhalation	City of Whittier Municipal water users	Past, current, and future
Omega Site	Soil	On-site workers, especially maintenance workers, located on the Omega site	Skin absorption, incidental ingestion, and inhalation	On-site and Maintenance Workers	Future

APPENDIX D - TOXICOLOGICAL PROFILES FOR CHEMICALS

Volatile Organic Chemicals

Acetone

- Acetone is a chemical that is found naturally in the environment and is also produced by industries.
- Low concentrations of acetone are normally present in the body from the breakdown of fat; the body can use it in normal processes that make sugar and fat. People and animals breathe out acetone produced from the natural breakdown of body fat.
- People may be exposed to small amounts of acetone by breathing air, drinking water, and eating food with acetone. Several consumer products, including certain nail polish removers, particle board, some paint removers, many liquid or paste waxes or polishes, and certain detergents or cleansers, contain acetone. People who work in certain industries that process and use acetone can be exposed to higher concentrations than the general populace. These industries include certain paint, plastic, artificial fiber, and shoe factories.
- In occupational settings, workers exposed to high concentrations, which are not normally found in the environment, of acetone experienced headaches, lightheadedness, dizziness, unsteadiness, and confusion depending on the length of time they were exposed.
- EPA's chronic oral RfD is 0.1 mg/kg/day (critical endpoint: increased organ weights & nephrotoxicity in rats).
- The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) has not classified acetone for carcinogenic effects. The EPA has determined that acetone is not classifiable as to its human carcinogenicity.

Benzene

- Benzene is a colorless liquid with a sweet odor.
- Benzene is commonly found in the environment. Industrial processes are the main sources of benzene in the environment. Benzene concentrations in the air can increase from emissions from burning coal and oil, benzene waste and storage operations, motor vehicle exhaust, and evaporation from gasoline service stations. Since tobacco smoke contains high concentrations of benzene, tobacco smoke is another source of benzene in air.
- Most people are exposed to a small amount of benzene on a daily basis. Exposure of the general population to benzene is mainly through breathing air that contains benzene. Individuals employed in industries that make or use benzene may be exposed to the highest concentrations of benzene. These industries include benzene production (petrochemicals, petroleum refining, and coke and coal chemical manufacturing), rubber tire manufacturing, and storage or transport of benzene and petroleum products containing benzene.
- Workers in occupational settings are exposed to concentrations of benzene in air far greater than the concentrations normally encountered by the general population. Very

high concentrations, which are not normally found in the environment, of benzene in air can result in death. Lower concentrations can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. In most cases, people will stop feeling these effects when they stop being exposed and begin to breathe fresh air.

- The DHHS, IARC and EPA have determined that benzene is carcinogenic to humans.

Chloroform

- Chloroform is a colorless liquid with a pleasant, nonirritating odor and a slightly sweet taste. Most of the chloroform found in the environment comes from industry.
- Chloroform enters the environment from chemical companies and paper mills. It is also found in waste water from sewage treatment plants and drinking water to which chlorine has been added.
- People may be exposed to small amounts of chloroform in drinking water and in beverages (such as soft drinks) made using water that contains chloroform. You can also get small amounts of chloroform in your body by eating food, by breathing air, and by skin contact with water that contains it. People who work at or near chemical plants and factories that make or use chloroform can be exposed to higher-than-normal amounts of chloroform.
- In humans, chloroform affects the central nervous system (brain), liver, and kidneys after a person breathes air or drinks liquids that contain large amounts of chloroform. Breathing high concentrations of chloroform for a short time causes fatigue, dizziness, and headache. Long term exposure to high concentrations of chloroform may cause liver and kidney damage.
- ATSDR's chronic oral MRL is 0.01 mg/kg/day (critical endpoint: hepatotoxicity in mice).
- IARC has determined that chloroform is possibly carcinogenic to humans. EPA has determine that chloroform is a probable human carcinogen.

Benzo(a)pyrene

- Benzo(a)pyrene is one of the polycyclic aromatic hydrocarbon (PAH) compounds.
- Because it is formed when gasoline, garbage, or any animal or plant material burns, it is usually found in smoke and soot. This chemical combines with dust particles in the air and is carried into water and soil and onto crops.
- People may be exposed to benzo(a)pyrene from environmental sources such as air, water, and soil and from cigarette smoke and cooked food. Workers who handle or are involved in the manufacture of PAH-containing materials may also be exposed to benzo(a)pyrene. Typically, exposure for workers and the general population is not to benzo(a)pyrene alone but to a mixture of similar chemicals.
- The most common way benzo(a)pyrene enters the body is through the lungs when a person breathes in air or smoke containing it. It also enters the body through the digestive system when substances containing it are swallowed.

- The DHHS has determined that benzo(a)pyrene may reasonably be anticipated to be a carcinogen.

1,2-Dichloroethane

- 1,2-dichloroethane is a clear, manufactured liquid that is not found naturally in the environment. It evaporates quickly at room temperature and has a pleasant smell and a sweet taste.
- The most common use of 1,2-dichloroethane is to make vinyl chloride, which is used to make a variety of plastic and vinyl products including polyvinyl chloride (PVC) pipes and other important construction materials, packaging materials, furniture and automobile upholstery, wall coverings, housewares, and automobile parts.
- 1,2-dichloroethane can enter the environment when it is made, packaged, shipped, or used.
- People are exposed to 1,2-dichloroethane mainly by breathing air or drinking water that contains 1,2-dichloroethane. Exposure usually happens where the chemical has been improperly disposed of, or spilled onto the ground. People can be exposed to low concentrations of 1,2-dichloroethane through the skin or air by contact with old products made with 1,2-dichloroethane, such as cleaning agents, pesticides, and adhesives used to glue wallpaper and carpets. Such exposure is probably not enough to cause harmful health effects.
- People who were accidently exposed to large amounts of 1,2-dichloroethane in the air or who swallowed 1,2-dichloroethane by accident or on purpose often developed nervous system disorders and liver and kidney disease.
- The DHHS has determined that 1,2-dichloroethane may reasonably be expected to cause cancer. The IARC has determined that 1,2-dichloroethane can possibly cause cancer in human. And, EPA has determined that 1,2-dichloroethane is a probably human carcinogen.

1,1-Dichloroethene

- 1,1-Dichloroethene is a chemical used to make certain plastics (such as packaging materials, flexible films like SARAN) and flame-retardant coatings for fiber and carpet backing. It is a colorless liquid that evaporated quickly at room temperature.
- 1,1-Dichloroethene can enter the environment when it is released to the air during its production or released to surface water or soil as a result of waste disposal.
- 1,1-Dichloroethene is found at very low concentrations in indoor and outdoor air, therefore, the potential for exposure in the environment is extremely low. The amounts are somewhat higher near some factories that make or use 1,1-dichloroethene (those that make food-packaging films, adhesives, flame-retardant coatings for fiber and carpet backing, piping, and coating for steel pipes).
- Information on the health effects in humans after breathing 1,1-dichloroethene is insufficient. People who breathed high amounts in a closed space lost their breath and fainted. Available information indicates that prolonged inhalation of 1,1-dichloroethene

can induce adverse neurological effects and is possibly associated with liver and kidney damage in humans.

- ATSDR's chronic oral MRL is 0.009 mg/kg/day (critical endpoint: hepatic effects in rats).
- The DHHS has not classified 1,1-dichloroethene with respect to carcinogenicity. The IARC has determined that 1,1-dichloroethene is not classifiable as to its carcinogenicity in humans. The EPA has determined that 1,1-dichloroethene is a possible human carcinogen.
-

FREON-11, Trichlorofluoromethane

- Trichlorofluoromethane is a colorless, volatile liquid or a gas at 75F.
- It is used as a refrigerant, solvent, in foam production and in making fire extinguishers.
- Trichlorofluoromethane can irritate the skin and eyes. Repeated exposure can cause dryness and cracking of the skin. Breathing trichlorofluoromethane can irritate the lungs causing coughing and/or shortness of breath. Overexposure can make you feel lightheaded and dizzy. High exposure can cause irregular heart beat, which can be fatal.
- EPA's chronic oral RfD is 0.3 mg/kg/day.
- The International Agency for Research on Cancer (IARC) has not classified trichlorofluoromethane for carcinogenic effects. The EPA has not made a determination as to the carcinogenicity of trichlorofluoromethane.

FREON-12, Dichlorodifluoromethane

- Dichlorodifluoromethane is a colorless, volatile liquid or a gas at 75F.
- It is used as a refrigerant, solvent, and in making fire extinguishers.
- Dichlorodifluoromethane can irritate the skin and eyes. Repeated exposure can cause dryness and cracking of the skin. Breathing Dichlorodifluoromethane can irritate the lungs causing coughing and/or shortness of breath. Overexposure can make you feel lightheaded and dizzy. High exposure can cause irregular heart beat, which can be fatal.
- EPA's chronic oral RfD is 0.2 mg/kg/day.
- The International Agency for Research on Cancer (IARC) has not classified dichlorodifluoromethane for carcinogenic effects. The EPA has not made a determination as to the carcinogenicity of dichlorodifluoromethane.

FREON-113, 1,1,2-Trichlorotrifluoroethane

- 1,1,2-Trichlorotrifluoroethane is a colorless, volatile liquid or a gas at 75F.
- It is used as a refrigerant, dry cleaning solvent, foam blowing agent and in making fire extinguishers.
- 1,1,2-Trichlorotrifluoroethane can irritate the skin and eyes. Repeated exposure can cause dryness and cracking of the skin. Breathing 1,1,2-trichlorotrifluoroethane can irritate the lungs causing coughing and/or shortness of breath. Overexposure can make

you feel lightheaded and dizzy. High exposure can cause irregular heart beat, which can be fatal.

- 96-hour LC50 for fathead minnow = 1250 ppm.
- EPA's chronic oral RfD is 30 mg/kg/day.
- The International Agency for Research on Cancer (IARC) has not classified 1,1,2-trichlorotrifluoroethane for carcinogenic effects. The EPA has not made a determination as to the carcinogenicity of 1,1,2-trichlorotrifluoroethane.
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Methlyene Chloride

- Methlyene chloride is a colorless liquid that has a mild sweet odor, evaporates easily, and does not easily burn. It is widely used as an industrial solvent and as a paint stripper. It can be found in certain aerosol and pesticide products and is used in the manufacture of photographic film. The chemical may be found in some spray paints, automotive cleaners, and other household products.
- People may be exposed to methylene chloride in air, water, food, or from consumer products. Because methylene chloride evaporates easily, the greatest potential for exposure is when you breathe vapors of contaminated air. Contact with consumer products such as paint strippers or aerosol cans that contain methylene chloride is another frequent source of exposure. The highest and most frequent exposures to methylene chloride usually occur in workplaces where the chemical is used.
- Breathing high concentrations of methylene chloride for long periods cause dizziness, nausea, tingling or numbness of the fingers and toes, and drunkenness. In most cases, effects disappear shortly after exposure ends.
- ATSDR's chronic oral MRL is 0.2 mg/kg/day (critical endpoint: hepatotoxicity in rats).
- The DHHS has determined that methylene chloride may reasonably be anticipated to be a carcinogen. The IARC has determined that methylene chloride is possibly carcinogenic to humans. The EPA has determined that methylene chloride is a probable human carcinogen

Tetrachloroethylene (10-13)

- Synthetic chemical used as a dry cleaning fluid, a degreaser, and as a starting material for other products
- Evaporates quickly, but breaks down very slowly
- Can travel easily through soils to reach groundwater
- Inhalation most common way to enter body, also ingestion if drinking water is contaminated
- Adverse health effects due to chronic inhalation exposure possibly include reproductive effects in women
- Higher concentrations of exposure in animals may cause liver, kidney damage
- EPA's chronic oral RfD is 0.01 mg/kg/day (critical endpoints: hepatotoxicity in mice and weight gain in rats).
- The IARC has determined that tetrachloroethylene is probably carcinogenic to human.

1,1,1-Trichloroethane

- 1,1,1-Trichloroethane is a synthetic chemical that does not occur naturally in the environment. It is used in commercial products, mostly to dissolve other chemicals, such as glues and paints. In industry, it is widely used to remove oil or grease from manufactured metal parts. In home, it may be an ingredient of products such as spot cleaners, glues, and aerosol sprays.
- Because 1,1,1-trichloroethane is used so frequently in home and office products, much more is usually found in the air inside buildings. Also, common consumer products that contain 1,1,1-trichloroethane include glues, household cleaners, and aerosol sprays. Thus, people are likely to be exposed to 1,1,1-trichloroethane vapor at higher concentrations indoors than outdoors or near hazardous waste sites. In the workplace, workers may be exposed to 1,1,1-trichloroethane while using some metal degreasing agents, paints, glues, and cleaning products.
- Breathing high concentrations of 1,1,1-trichloroethane for a short time may cause dizziness and lightheadedness, and the lost of coordination. Breathing very high concentrations of 1,1,1-trichloroethane , either intentionally or accidentally, may result in unconsciousness, decrease in blood pressure and the stoppage of the heart.
- The IARC has determined that 1,1,1-trichloroethane is not classifiable as to its carcinogenicity in humans. The EPA has also determined that 1,1,1-trichloroethane is not classifiable as to its human carcinogenicity.

Trichloroethylene

- Trichloroethylene is a nonflammable, colorless liquid at room temperature with a somewhat sweet odor and a sweet, burning taste. This manmade chemical does not occur naturally in the environment.
- Trichloroethylene is mainly used as a solvent to remove grease from metal parts. It can be found in some household products, including typewriter correction fluid, paint removers, adhesives, and spot removers.
- People may be exposed to trichloroethylene by its evaporation from paints, glues, and other products or by release from factories where it is made. People living near hazardous waste sites may be exposed to it in the air or in their drinking water used for bathing or cooking.
- People who are exposed to large amounts of trichloroethylene can become dizzy or sleepy and may become unconscious when exposed to very high concentrations. Death may occur from inhalation of large amounts.
- ATSDR's acute oral MRL is 0.2 mg/kg/day (critical endpoint: behavior changes in mice).
- The IARC has determined that trichloroethylene is probably carcinogenic to humans.

Metals

Antimony

- A silvery-white metal that is found in the earth's crust. Antimony ores are mined and then mixed with other metals to form antimony alloys or combined with oxygen to form antimony oxide.
- Antimony is released to the environment from natural sources and from industry.
- In the air, antimony is attached to very small particles that may stay in the air for many days. Most ends up in soil, where it attaches strongly to particles that contain iron, manganese, or aluminum.
- Because antimony is found naturally in the environment, the general population is exposed to low concentrations of it every day, primarily in food, drinking water, and air. Workers in industries that process it or use antimony ore may be exposed to higher concentrations.
- Exposure to antimony at high concentrations can result in a variety of adverse health effects; breathing high concentrations for a long time can irritate your eyes and lungs and can cause heart and lung problems, stomach pains, diarrhea, vomiting, and stomach ulcers.
- EPA's chronic oral RfD = 0.0004 mg/kg/day (critical endpoints: longevity, changes in blood glucose and cholesterol concentrations in rats).
- The DHHS, the International Agency for Research on Cancer (IARC) and the United States Environmental Protection Agency(USEPA) have not classified antimony as to its human carcinogenicity.

Arsenic

- Arsenic is found in nature at low concentrations.
- It's mostly in compounds with oxygen, chlorine, and sulfur; these are called inorganic arsenic compounds.
- Arsenic in plants and animals combines with carbon and hydrogen; this is called organic arsenic. Organic arsenic is usually less harmful than inorganic arsenic.
- In the environment, arsenic does not evaporate. Most arsenic compounds can dissolve in water. It can get into air when contaminated materials are burned, however, it settles from the air to the ground. In the ground, it does not break down, but it can change from one form to another. Fish and shellfish build up organic arsenic in their tissues, but most of the arsenic in fish is not toxic.
- You can be exposed to arsenic by breathing sawdust or burning smoke from wood containing arsenic; breathing workplace air; ingesting contaminated water, soil, or air at waste sites containing arsenic; or ingesting contaminated water, soil, or air near areas naturally high in arsenic.
- Lower concentrations of exposure to inorganic arsenic may cause: nausea, vomiting, and diarrhea; decreased production of red and white blood cells; abnormal heart rhythm;

blood vessel damage; and/or a "pins and needles" sensation in hands and feet.

- High concentrations of inorganic arsenic in food or water can be fatal. A high level is 60 parts of arsenic per million parts of food or water (60 ppm). Arsenic damages many tissues including nerves, stomach and intestines, and skin. Breathing high concentrations can give you a sore throat and irritated lungs.
- Long term exposure to inorganic arsenic may lead to a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.
- ATSDR's chronic oral MRL = 0.0003 mg/kg/day (critical endpoints: hyperpigmentation, keratosis & possible vascular complications in humans).
- The DHHS has determined that arsenic is a known carcinogen. Breathing inorganic arsenic increases the risk of lung cancer. Ingesting inorganic arsenic increases the risk of skin cancer and tumors of the bladder, kidney, liver, and lung.

Barium

- Barium is a silvery-white metal that occurs in nature in many different forms called compounds. Two forms of barium, barium sulfate and barium carbonate, are often found in nature as underground ore deposits. Barium is sometimes found naturally in drinking water and food. Other forms of barium compounds such as barium chloride, barium hydroxide, and barium nitrate are manufactured from barium sulfate.
- People may be exposed to barium when barium waste is released to air, land, and water during industrial operations. Also, exposure near hazardous waste sites may occur by breathing dust, eating soil or plants, or drinking water that is polluted with barium.
- The health effects of the different barium compounds depend on how well the specific barium compound dissolves in water. For example, barium sulfate does not dissolve well in water and has few adverse health effects. On the other hand, barium compounds, such as barium acetate, barium carbonate, and barium chloride, that dissolve in water can cause adverse health effects. Eating and drinking large amounts of barium compounds that dissolve in water may cause paralysis or death in a few individuals. Some people who eat or drink somewhat smaller amounts of barium for a short period may potentially have difficulties in breathing, increased blood pressure, changes in heart rhythm, stomach irritation, minor changes in blood, muscle weakness, changes in nerve reflexes, swelling of the brain, and damage to the liver, kidney, heart, and spleen.
- EPA's chronic oral RfD = 0.07 mg/kg/day (critical endpoint: no adverse effect in humans).
- The DHHS, IARC, and USEPA has not classified barium as to its carcinogenicity.

Chromium

- Chromium is a naturally occurring element found in rocks, soil, plants, animals, and in volcanic dust and gases.
- Chromium has three main forms: chromium (0), chromium (III), and chromium (VI). Chromium (III) compounds are stable and occur naturally in the environment. Chromium

(0) does not occur naturally and chromium (VI) occurs only rarely. Chromium compounds have no taste or odor.

- Chromium (III) is an essential nutrient in our diet, but we need only a very small amount. Other forms of chromium are not needed by our bodies.
- Chromium can enter the environment by the manufacturing, disposal of products or chemical containing chromium, or burning of fossil fuels release chromium to the air, soil, and water. Chromium particles settle from air in less than 10 days. Chromium sticks strongly to soil particles. Most chromium in water sticks to dirt particles that fall to the bottom; only a small amount dissolves. Small amounts move from soil to groundwater. Fish do not take up or store chromium in their bodies.
- You may be exposed to chromium by breathing contaminated workplace air (e.g., stainless steel welding, chromate or chrome pigment production, chrome plating, leather tanning, etc.). Handling or breathing sawdust from chromium treated wood. Breathing contaminate air, or ingesting water, or food from soil near waste sites or industries that use chromium. Very small amounts of chromium (III) are in everyday foods.
- All forms of chromium can be toxic at high concentrations, but chromium (VI) is more toxic than chromium (III). Breathing very high concentrations of chromium (VI) in air can damage and irritate your nose, lungs, stomach and intestines. People who are allergic to chromium may also have asthma attacks after breathing high concentrations of either chromium (VI) or (III).
- Long term exposures to high or moderate concentrations of chromium (VI) cause damage to the nose (bleeding, itching, sores) and lungs, and can increase your risk of non-cancer lung diseases. Ingesting very large amounts of chromium can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. Skin contact with liquids or solids containing chromium (VI) may lead to skin ulcers. Some people have allergic reactions including severe redness and swelling.
- EPA's chronic oral RfD = 0.005 mg/kg/day (critical endpoint: no adverse effects reported in rats).
- The DHHS has determine that certain chromium (VI) compounds are known carcinogens.

Nickel

- Pure nickel is a hard, silvery-white metal, which has properties that make it very desirable for combining with other metals to form mixtures called alloys. Nickel combined with other elements occurs naturally in the earth's crust. It is found in all soil and is also emitted from volcanos.
- Nickel may be released to the environment from the stacks of large furnaces used to make alloys or form power plants and trash incinerators. The nickel that comes out of the stacks of power plants is attached to small particles of dust that settle to the ground or are taken out of the air in rain.
- People may be exposed to nickel by breathing air, drinking water, eating food, or smoking tobacco containing nickel. Skin contact with soil, water, or metals containing nickel as well as with nickel plated with nickel can also result in exposure.
- The most common adverse health effect of nickel in humans is an allergic reaction to

nickel. People can become sensitive to nickel when jewelry or other things containing nickel are in direct contact with the skin. Once a person is sensitized to nickel, further contact with the metal will produce a reaction. The most common reaction is a skin rash at the site of contact. People who are not sensitive to nickel must eat very large amounts of nickel to suffer adverse health effects.

- The most serious effects of nickel, such as cancer of the lung and nasal sinus, have occurred in people who have breathed dust containing nickel compounds while working in nickel refineries or in nickel processing plants. Other lung effects including chronic bronchitis and reduced lung function have been observed in workers breathing nickel. Current concentrations of nickel in workplace air are much lower than in the past, and few workers have symptoms from nickel exposure.
- EPA's chronic oral RfD = 0.02 mg/kg/day (critical endpoint: decreased body and organ weights in rats).
- The DHHS has determined that nickel and certain nickel compounds may reasonably be anticipated to be carcinogens. The IARC has determined that some nickel compounds are carcinogenic to humans and that metallic nickel may possibly be carcinogenic to humans. The USEPA has determined that nickel refinery dust and nickel sulfide are human carcinogens.

Vanadium

- Vanadium is a natural element in the earth. It is a white to gray metal, often found as crystals. It has no particular odor. Vanadium occurs naturally in fuel oils and coal. In the environment it is usually combined with other elements such as oxygen, sodium, sulfur, or chloride.
- Most people are exposed daily to very low concentrations of vanadium in food, drinking water, and air. Most of your intake is from food. The vanadium in these sources is at least partially due to naturally occurring vanadium in rocks and soil.
- People are exposed to vanadium by breathing it into your lungs and eating or drinking small amounts in food and water.
- ATSDR's intermediate oral MRL = 0.003 mg/kg/day (critical endpoints: mild histological changes in kidneys, lungs, and the spleen in rats).
- If you breathe large amounts of vanadium dusts for short or long periods, you will have lung irritation that can make you cough, and you can also develop a sore throat and red irritated eyes. No studies designed to look for cancer in laboratory animals exposed to vanadium were found.

APPENDIX E - ASSUMPTIONS USED IN KARIMI AIR MODEL

ASSUMPTIONS USED IN KARIMI AIR MODEL

The Karimi Model is a diffusion-based air screening model used to approximate the migration of vapors from soil or groundwater into buildings above contamination sources. While the Karimi Model is rather simplistic, it is useful because it provides a rapid evaluation of a number of elements that affect the concentration of soil gas contaminants. In addition, the elements considered by the Karimi Model can be estimated or chosen with the intention of producing an estimate of a "worst case" exposure scenario.

The following assumptions were made pertaining to the Omega Chemical Site Karimi Model:

1. The distance between gas vapors and model buildings is 6 feet or 1.83 meters.

2. Assume that 100% of vapors that reach building foundations will enter the building.

3. The air exchange rate used for the Administration Building was 0.5/hour based on Mueller, et.al., 1988. Due to the ventilated condition of the warehouse, the air exchange rate used for calculations of the gases in the warehouse was 1.0/hour.

4. Air filled porosity was assumed to be 0.30 (maximum).

5. Total porosity was assumed to be 0.47, per Weiss Assoc., 1988.

6. The area of the warehouse crawl space was estimated to be 2.4 square meters.

7. The area of the Administration Building was estimated to be 0.85 square meters.

8. The volume of air in the warehouse was estimated to be 20400 cubic meters.

9. The volume of air in the Administration Building was estimated to be 612 cubic meters.

10. The universal gas constant utilized for this model was 0.000082 M^3 atm mol^{-1} K^{-1}

Additionally, it should be noted that a number of additional values are chemical specific values, such as Henry's Law Constant and the vapor phase diffuse coefficient in air.